arc type 15F vhf navigation equipment

Aircraft Radio Corporation
Boonton, New Jersey

ARC TYPE 15F VHF NAVIGATION EQUIPMENT

Aircraft Radio Corporation
Boonton, New Jersey

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WARRANTY

Aircraft Radio Corporation (ARC) warrants each item of new equipment manufactured by it to be free from defects in material and workmanship under normal service use for which intended. ARC obligates itself under this warranty to replace or repair (at ARC discretion), at its factory, any ARC equipment, or major unit thereof (excluding vacuum tubes and transistors), which shall within one year after delivery to the original purchaser thereof be returned, transportation charges prepaid, to ARC with a statement from an authorized ARC Distributor or Dealer establishing the date of such delivery, which ARC examination shall disclose to have been defective in manufacture. This warranty shall not apply to any equipment, or major unit thereof, which, in the judgment of ARC, has been repaired or altered in any way so as adversely to affect its performance or reliability, or which has been subject to misuse, negligence or accident. This warranty is in lieu of all other guaranties or warranties express or implied. The obligation and responsibility of ARC for or with respect to defective equipment shall be limited to that expressly provided herein and ARC shall not be liable for consequential or other damage or expense whatsoever therefor or by reason thereof.

ARC reserves the right to make changes in design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

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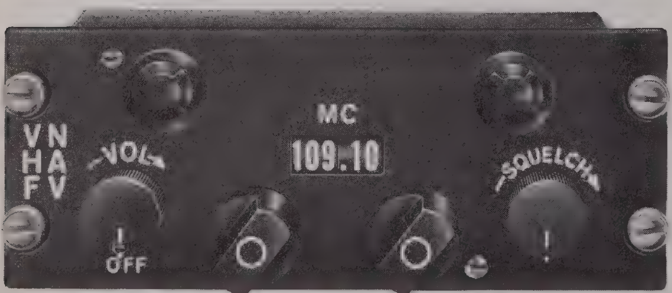

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TP1410

Figure 1–1. ARC Type 15F VHF Navigation Equipment, Major Units

SECTION I
GENERAL INFORMATION

1—1. INTRODUCTION.

This instruction book contains operation, installation, principles of operation, and maintenance information for the ARC Type 15F VHF Navigation Equipment, manufactured by Aircraft Radio Corporation, Boonton, New Jersey.

1—2. PURPOSE.

The ARC Type 15F VHF Navigation Equipment (see Figure 1–1) is an airborne, 190-channel, navigation-communication radio receiving set, with a frequency range of 108.00 through 126.90 megacycles. The principal function of the Type 15F is to receive and interpret vhf omnidirectional range (VOR) and localizer signals. In addition, the equipment may be used as the receiver section of a vhf transmitter-receiver communication system when used with a suitable vhf transmitter.

1—3. SPECIFICATIONS.

Over-all Characteristics.

Function:	Provides visual presentation of navigational data derived from VOR and localizer signals; also functions as receiver for vhf communication system
Total Input Power:	4.9 amperes at 14 volts dc 2.5 amperes at 28 volts dc
Total Weight:	Approximately 26 pounds, dual-unit-rack installation Approximately 27 pounds, single-unit-rack installation
Environmental Limit:	Meets FAA TSO C-36, C-38, and C-40, Category A

R-34A Receiver.

Frequency:	108.00–126.90 mc
Number of Channels:	190
Channel Spacing:	100 kc (0.1 mc)
Channeling Time:	4 seconds, maximum
Input Power:	14-volt model: 3.6 amperes at 13.75 volts dc (using ARC Type DV-11A Dynaverter®) 28-volt model: 1.8 amperes at 27.5 volts dc (using ARC Type DV-10A Dynaverter®)
High-voltage Power:	85 ma at 260 volts dc
Circuit:	14-tube superheterodyne, double-conversion, crystal-controlled
Input Impedance:	50 ohms, nominal
Sensitivity:	6 db S+N/N with 3 hard[1] microvolts, or less, at 1000 cps, 30% modulation. Agc knee no higher than 5 μv
Bandwidth:	6 db down ± 24 kc from center frequency 60 db down ± 70 kc from center frequency
Tuning:	Electrically actuated, crystal-controlled. Nineteen crystals on megacycle drum; fundamental frequency range: 48.15–57.15 mc in 0.5-mc steps. Ten crystals on fractional megacycle drum; frequency range: 10.00–10.90 mc in 0.1-mc steps
Intermediate Frequencies:	First i-f: Variable, 11.70–12.60 mc Second i-f: Fixed, 1.7 mc
I-f Rejection:	At least 100 db
Image Rejection:	At least 70 db
Spurious Response Rejection:	At least 80 db
Agc:	Output constant within 4.5 db from 10 to 200,000 μv
Audio Output:	With 1000 cps, 30% modulation, 108.00–117.90 mc, at least 300 mw into 300 ohms With 1000 cps, 30% modulation, 118.00–126.90 mc, at least 70 mw into 300 ohms With 1000 cps, 85% modulation, 118.00–126.90 mc, at least 300 mw into 300 ohms
Squelch Sensitivity:	Adjustable from 0.1–5 μv (may be extended to 15 μv by adjustment of i-f sensitivity control, which also affects agc knee)
Total Harmonic Distortion:	Less than 25% with 100 μv, 350–2500 cps modulation
Audio Frequency Response:	Within 6 db of rated output from 350 cps to 2500 cps

[1] Hard microvolts are defined as equivalent open-circuit microvolts across a 50-ohm source.

Tube Complement:	5718, 5718 R-f cascode amplifier 6021 MC crystal oscillator, doubler 5899 First mixer 5718 Fractional mc crystal oscillator 5899 Second mixer 5899 First 1.7-mc i-f amplifier 5899 Second 1.7-mc i-f amplifier 5899 Third 1.7-mc i-f amplifier 5840 Fourth 1.7-mc i-f amplifier 5896 Detector, agc 6112 Squelch control, noise limiter 6021 First a-f amplifier, squelch, cathode follower 5902 Audio output
Mounting:	ARC Type E-15 Rack on ARC Type M-25 Mounting for single-unit-rack installation; or ARC Type E-14 Rack on ARC Type M-10 Mounting for dual-unit-rack installation

B-13A-1 Converter.

Input Power:	0.87 ampere at 14 volts dc 0.52 ampere at 28 volts dc
High-voltage Power:	22 ma at 260 volts dc (VOR operation) 7 ma at 260 volts dc (localizer operation)
Tube Complement:	5670 10-kc amplifier, 30-cps amplifier 5783 Voltage regulator 5670 10-kc amplifier, 30-cps amplifier 5670 Cathode follower, 30-cps amplifier 5751 Dual 30-cps amplifier 5814A Dual 90/150-cps amplifier 12AT7 Electronic switch
Mounting:	ARC Type E-16 Rack on ARC Type M-25 Mounting for single-unit-rack installation; or ARC Type E-14 Rack on ARC Type M-10 Mounting for dual-unit-rack installation

DV-10A and DV-11A Dynaverters.

DV-10A Input Power:	1.22 amperes at 26 volts dc (100-ma output)
DV-11A Input Power:	2.60 amperes at 12 volts dc (100-ma output)
Output Voltage:	260 volts dc at 100 ma
Output Current:	200 ma maximum, continuous, at 55° C 100 ma maximum, continuous, at 71° C 200 ma maximum, intermittent, at 71° C
Regulation:	2% nominal (15–150 ma output)
Efficiency:	85% (100-ma output)
Temperature Rise:	11° C, or less (100-ma output)
Ripple:	0.3% nominal
Mounting:	Integral snapslide fasteners

C-81A Control Unit.

Controls:	Combination off-on switch and volume control, megacycle and fractional megacycle channel selectors, and squelch control
Input Power:	160 ma at 14 volts dc; 80 ma at 28 volts dc

1–4. UNITS SUPPLIED.

The units and accessories which comprise the Type 15F are listed in Table 1–1. The units are shown in Figure 1–1.

1–5. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Cable assemblies required for interconnecting the units of the Type 15F are not supplied. The required cable assemblies are fabricated from individual wires, which are not supplied, and from the supplied connectors and coaxial cable listed in Table 1–1. The wire size and the connectors for interconnecting cables in either single-unit-rack or dual-unit-rack installations will vary with each installation. The actual length of the cables will depend on the location of the equipment in the aircraft.

1–6. DESCRIPTION OF UNITS.

Receiver. The ARC Type R-34A Receiver is a 14-tube, crystal-controlled, double-conversion, superheterodyne receiver which operates in the frequency range of 108.00–126.90 mc. The R-34A provides an aural output for headset operation and a navigation output which is fed to the converter. Tuning is accomplished electrically from a remote point by a control unit such as the ARC Type C-81A. The electrically controlled tuning circuits eliminate the need for mechanical linkage between the R-34A and the control unit. The receiver uses 29 crystals to provide 190 crystal-controlled channels spaced 100 kc apart.

A squelch control, and connectors for the antenna, control unit, and auxiliary equipment, are located on the front panel of the receiver. The squelch control is used to set the awakening sensitivity (squelch threshold level) of the receiver. The auxiliary-equipment connector, normally covered by a cap, is used for connecting the receiver high-voltage supply to other equipment, such as the ARC Type T-25A VHF Transmitter. A wired plug is used to complete the receiver high-voltage circuit when auxiliary equipment is not connected.

Note

Unless auxiliary equipment is connected, the wired plug must be left in place.

TABLE 1—1. UNITS AND ACCESSORIES SUPPLIED

Quantity per Installation		Name	ARC Type No.	ARC Part No.	Over-all Dimensions (In.)			Weight
Single-unit Rack	Dual-unit Rack				Height	Width	Depth	(Lb.)
		UNITS						
1	1	Antenna [1]	A-13B	15823	10¼	28	21¼	3.6
1	1	Control Unit [1 4]	C-81A	21410	2¼	5¾	3¾	1.4
1	1	Converter [2]	B-13A-1	22900(*)	5½	4¾	11½	6.1
1	1	Dynaverter [1 3]	DV-10A	19840	3⅜	4 15/16	2 15/16	1.7
1	1	Dynaverter [1 3]	DV-11A	21100	3⅜	4 15/16	2 15/16	1.6
1	1	Indicator [1]	IN-10	16706	3¼	3¼	7¼	3.3
—	1	Mounting	M-10	12901	1½	11 13/16	10 29/32	0.8
2	—	Mounting	M-25	16780	1½	6⅞	10 29/32	0.7
—	1	Rack [2]	E-14	15880(*)	3⅞	11	13⅛	2.3
1	—	Rack [2]	E-15	16760(*)	3⅞	6	13⅛	1.3
1	—	Rack	E-16	16770	3⅞	6	13⅛	1.3
1	1	Receiver [2]	R-34A	21440(*)	5½	4⅝	11 3/16	6.7
		ACCESSORIES						
1	1	Cable, coaxial	—	11318 (20 ft)	—	—	—	1.00
4	2	Connector, coaxial	—	11337	—	—	—	0.03
2	2	Connector, plug	—	14050	—	—	—	0.07
1	1	Connector, plug	—	14320	—	—	—	0.14
—	1	Connector, plug	—	14321	—	—	—	0.04
1	—	Connector, plug	—	15911	—	—	—	0.07
1	1	Connector, plug	—	15912	—	—	—	0.07
2	2	Connector, plug	—	16115	—	—	—	0.14
1	—	Connector, plug	—	16210	—	—	—	0.07
1	1	Instruction Book	—	701-0085	—	—	—	—

[1] The A-13B, C-81A, DV-10A or DV-11A, and IN-10 may be replaced (if specified) by alternative units. Refer to paragraph 1–7, *Alternative Units*.
[2] The B-13A-1 Converter, E-14 and E-15 Racks, and R-34A Receiver are supplied for either 14-volt or 28-volt dc operation as specified. Voltage is indicated in place of asterisk to complete part number.
[3] Only one Dynaverter is required for operation. The DV-10A is used for 28-volt operation; the DV-11A is used for 14-volt operation.
[4] The C-81A is normally supplied with 28-volt lamps. When 14-volt operation is specified, ARC-21760 Lamp Kit is supplied in place of the two ARC-8622(28V) lamps.

Four vibration mounts and an input connector for the ARC Type DV-10A or DV-11A Dynaverter are located on the top of the power supply filter section of the receiver i-f/a-f assembly. A connector, used for interconnecting the receiver and the ARC Type E-14 or E-16 Rack, is located at the rear of the R-34A.

Converter. The ARC Type B-13A-1 Converter is a six-tube unit designed to accept VOR and localizer signals from the R-34A Receiver. The B-13A-1 converts these signals to a form that is presented visually by a course indicator such as the ARC Type IN-10 or IN-14. The unit has no operating controls. All operating voltages are received from the R-34A and the external low-voltage power source. Input and output connectors, located at the rear of the chassis, mate with connectors on an ARC Type E-14 or E-16 Rack. Five adjustment controls are located on the front panel. These controls are not required for any operating procedure and are set and locked during alignment of the B-13A-1.

Control Unit. The ARC Type C-81A Control Unit provides the following:

1. Remote power control of the Type 15F
2. Control of the receiver audio output
3. Remote tuning control of the R-34A Receiver
4. Automatic selection of VOR or localizer operation
5. Remote control of the receiver squelch circuit
6. Automatic equalizing of the receiver audio output

Power for the Type 15F Equipment and the audio output level of the R-34A Receiver are controlled at the C-81A by an off-on rotary switch combined with a variable resistor. Two switches on the control unit are used to select the desired frequency and to select automatically the type of signal (VOR or localizer). The switches control the grounding and interconnection sequence of ten wires which are used to form two five-wire, open-seeking, binary, re-entrant switching circuits. These circuits "slave" the receiver tuning circuits to the settings of the channel selector switches on the control unit. On even-tenth-megacycle switch positions, between the frequencies of 108.00 and 111.90 mc, the equipment is set up for VOR operation; on odd-tenth-megacycle positions, the localizer mode of operation is automatically selected. VOR operation is automatically selected when the channel selector switches are set to frequencies between 112.00 and 117.90 mc. When set to frequencies between 118.00 and 126.90 mc, the switches cause the tuner assembly to activate an audio-equalizing circuit. The

equalizing circuit reduces the high-level modulation signals to the level obtained from navigation-band audio signals. In addition to the VOL-OFF control and the channel selector switches, the control unit also contains a SQUELCH control.[2] When the control is placed in the OFF position (maximum counterclockwise rotation), the receiver squelch circuit is disabled and the receiver is awake. The degree of clockwise rotation determines the receiver squelch threshold level.

Edge-lighting of the C-81A is provided by two midget, flange-base lamps installed in red-filter light assemblies located on the front panel. Power for these lamps is brought in through a separate wire and is controlled by the electrical system panel-light control. The light is transmitted through a plastic panel, which has an opaque finish, to translucent white index lines and control designations on the face of the panel. Light is also transmitted through translucent areas behind the volume, squelch, and frequency selector knobs to a translucent white circle on each knob. When power is applied to the equipment, the translucent white areas glow red, permitting easy identification of the controls and their settings.

Dynaverter. The ARC Type DV-10A and DV-11A Dynaverters are transistorized power supplies that furnish high voltage to the R-34A Receiver, B-13A-1 Converter, and auxiliary equipment connected to the R-34A. The DV-10A operates on 28 volts dc and the DV-11A on 14 volts dc. A receptacle on the bottom of the unit mates with a polarized connector on the receiver. The Dynaverter is shock-mounted on the four vibration mounts located on the receiver chassis. The unit is secured in position by four snapslide fasteners.

Indicator. The ARC Type IN-10 Course Indicator is a combined deviation indicator, course selector, and to-from meter. The deviation indicator is a special type of microammeter with two pointer mechanisms, and two flag mechanisms for indicating the operating or nonoperating condition of the pointers.

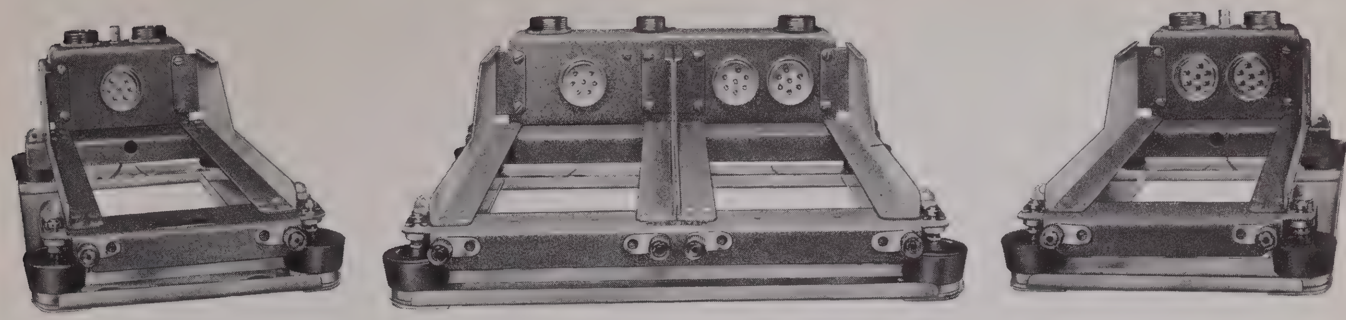
The vertical pointer visually indicates the VOR or localizer information received from the B-13A-1 Converter circuits. It is pivoted at the top and moves left or right to supply a visual indication of the lateral position of the aircraft with respect to the on-course signal of the VOR or localizer. The horizontal pointer is pivoted at the left and moves up and down. This pointer is used with a glide slope receiver to show the relation of the aircraft to the glide slope. Fluorescent blue and yellow sectors are included for flying the visual courses of localizers. A red flag is associated with each pointer. The flag and the to-from meter indicate the presence or absence of proper output signals from the B-13A-1 Converter.

[2] Control units with Serial No. 101–117 contain an spst squelch disabling switch in place of this control.

The course selector portion of the IN-10 permits the selection of any course to or from a VOR station or indicates the magnetic bearing of the aircraft with relation to a VOR station. The course selector dial is graduated in a compass scale of 360°. A triangle-shaped pointer is used for the course indication and a ball for the reciprocal indication on the course indicator scale. The to-from meter is a zero-center d-c instrument that provides the sense information required to resolve any ambiguity in the reading of the course indicator dial. The meter will show TO when the indicated bearing on the course indicator dial is the magnetic bearing to the station, or FROM when the bearing on the course indicator dial is the magnetic bearing from the station. When reading the to-from meter, the vertical pointer should be approximately centered. When neither TO nor FROM is indicated, it may be that the indication is passing through the neutral point on the way from one indication to the other, or the received signal may be too weak to be reliable, or the received signal may not be a proper signal. In addition to the lack of a TO-FROM indication, an improper signal or a signal that is too weak to be reliable will cause the flag to show.

Racks. The ARC Type E-14 Rack (see Figure 1–2), designed to support both the R-34A Receiver and the B-13A-1 Converter, is used in dual-unit-rack installations. The ARC Type E-15 and E-16 Racks, used in single-unit-rack installations, are designed to support the R-34A and B-13A-1, respectively. The racks also serve as the terminal junction box for all units of the Type 15F. When the E-14 is used, the R-34A and the B-13A-1 are installed in individual compartments and secured by means of nut-and-link arrangements that engage the conical studs located on the front of the units. The E-15 and E-16 are used where space limitations prevent the use of the E-14 Rack, or where it is desirable to locate one unit remotely from the other; there is no practical limit to the allowable separation between units under this condition. In all racks, the electrical parts are contained in an enclosure at the rear of the rack. The circuit of the E-14 is duplicated in the E-15 and E-16.

Mountings. The ARC Type M-10 Mounting is provided to support the E-14 Rack. The ARC Type M-25 Mounting is used to support the E-15 Rack or E-16 Rack (see Figure 1–2). Vibration mounts are used at each corner of the mountings. The racks are secured to their respective mountings by four snapslides which engage the grooved studs of the vibration mounts. Two ground straps fastened from the two rear vibration mounts to the channel frame ground the mounting to minimize r-f noise. Eight holes in the M-10 channel frames and four holes in the M-25 channel frames are provided for securing the mountings, with the attaching hardware also serving to ground the mounted components.



E-15 RACK ON M-25 MOUNTING

E-14 RACK ON M-10 MOUNTING

E-16 RACK ON M-25 MOUNTING

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Figure 1–2. Single-unit and Dual-unit Racks and Mountings

Antenna. The ARC Type A-13B Antenna is a "ramshorn" antenna with two dipoles. The forward dipole is used for glide-slope signal reception. The **V**-shaped rear dipole is used for reception of VOR and other signals. Each antenna is terminated with a UG-291/U coaxial connector, located in the antenna base. The dipoles are set in a rubber block, which in turn is fastened to an aluminum pedestal support. The A-13B is designed for mounting on any relatively flat portion of the aircraft structure. The pedestal support has two $\frac{1}{16}$-inch radius drainage tunnels at its base that permit the escape of accumulated moisture when the A-13B is mounted in an upright position. When the A-13B is mounted in an inverted position, it is necessary to drill through the white-marked, $\frac{5}{32}$-inch diameter depression in the top of the rubber block to provide for moisture drainage.

Caution

Take care to drill only through the rubber. The antenna will be damaged if the drill penetrates too deeply.

1–7. ALTERNATIVE UNITS.

General. An alternative antenna, control unit, course indicator, and high-voltage power supply may be used in place of the similar-purpose units listed in Table 1–1. Descriptive information concerning these alternative units follows.

Antenna Coupler. The ARC Type A-17 Antenna Coupler is a network designed to permit the coupling of a VOR dipole antenna to a nominal 50-ohm coaxial cable. The A-17 is intended for use with dipole antennas which are part of the aircraft. The circuit is installed on a mounting base and is enclosed by a screw-attached cover. Two post-type terminals for connecting the dipole rods extend through the cover. A UG-290A/U coaxial connector is provided for connecting the A-17 (through RG-58/U coaxial cable terminated with UG-88C/U connectors) to the R-34A Receiver.

C-88A Control Unit. The ARC Type C-88A Control Unit is used for simultaneous control of the Type 15F and the ARC Type R-31A Glide Slope Receiver. Except for a slight increase in the depth of the unit, the C-88A is identical in appearance to the C-81A. In addition to controlling the Type 15F, the C-88A also automatically tunes the R-31A Receiver to the associated glide-slope frequency when a localizer frequency is selected.

Custom Control Units. The ARC Type CC-11A or CC-12A Custom Control Unit may be used to perform the automatic switching and channel selection functions of the C-81A or the C-88A, respectively. The parts required for the custom installation are listed in Table 1–2.

TABLE 1–2. CUSTOM CONTROL UNIT PARTS

Qty	Name	ARC Part No.
1	ARC Type CC-11A Custom Control Unit [1,2]	24030
1	ARC Type CC-12A Custom Control Unit [1,2]	22970
1	Volume Control and Switch	8862
2	Lockwasher	8540
2	Nut	4697
1	Squelch Control	23738
2	Knob Assembly	16331

[1] Control knobs, Mask ARC-24044 (for metal panels), Mask ARC-24638 (for plastic panels), and mounting hardware are supplied with the custom control unit. Mask ARC-24638 should be used when the CC-11A or CC-12A is installed in aircraft which use a plastic panel in front of the metal mounting panel.

[2] The CC-11A is used to control the Type 15F. The CC-12A is used to control both the Type 15F and the ARC Type R-31A Glide Slope Receiver.

Dynamotor. The appropriate ARC Type D-10A Dynamotor (14 volts or 28 volts dc) may be used in place of the DV-10A or DV-11A Dynaverter. The dynamotor is mounted on the receiver in the same manner and location as the Dynaverter. The 28-volt model of the D-10A

has a rated input of 1.7 amperes at 27.5 volts dc and a rated output of 85 ma at 250 volts dc. The 14-volt model has a rated input of 3.4 amperes at 13.75 volts dc with the same output.

Course Indicator. The ARC Type IN-14 Course Indicator is used instead of the ARC Type IN-10 Course Indicator when the Type 15F is operated with the ARC Type CD-1 or Type CD-2 Course Director. The IN-14 is similar in function and design to the IN-10; however, besides performing the functions of the IN-10, the IN-14 provides the computer unit of the Type CD-1 or Type CD-2 with information regarding the magnetic bearing of the desired course. For further details, refer to the instruction book for the ARC Type CD-1 or Type CD-2 Course Director.

1–8. VOR AND ILS FREQUENCY ALLOCATIONS. The Type 15F receives and interprets vhf omnidirectional range (VOR) and localizer signals. Its frequency range of 108.00–126.90 mc also permits the reception of vhf communication signals.

The FCC has allocated certain frequency bands for aeronautical navigation and communication facilities. Localizer and VOR facilities are located between 108.00 and 117.90 mc, communication facilities between 118.00 and 131.90 mc, and glide slope facilities between 328.6 and 335.4 mc.

Within the localizer-VOR band, specific frequencies are assigned to each facility as follows: All odd-tenth-megacycle frequencies, beginning with 108.1 mc and ending with 111.9 mc, are localizer frequencies. All even-tenth-megacycle frequencies, beginning with 108.2 mc and ending with 112.0 mc, are VOR frequencies. The remaining frequencies, from 112.1 to 117.9 mc, both odd and even tenths, are assigned to VOR facilities only.

The glide slope frequency band is divided into four frequency groups related to the 108-, 109-, 110-, and 111-mc localizer bands. In each group, five glide slope frequencies are paired with specific localizer frequencies as follows:

Localizer Frequency	Glide Slope Frequency
108.1	334.7
108.3	334.1
108.5	329.9
108.7	330.5
108.9	329.3
109.1	331.4
109.3	332.0
109.5	332.6
109.7	333.2
109.9	333.8
110.1	334.4
110.3	335.0
110.5	329.6
110.7	330.2
110.9	330.8
111.1	331.7
111.3	332.3
111.5	332.9
111.7	333.5
111.9	333.1

The use of the ARC Type C-88A Control Unit with the Type 15F and an ARC Type R-31A Glide Slope Receiver, or any other glide slope receiver having ARINC control wiring, permits the simultaneous and automatic selection of the correct glide slope frequency with the selected localizer frequency.

Though, at present, only eight glide slope and localizer frequencies are active (within the 109- and 110-mc localizer bands), the Type 15F, C-88A, and R-31A are designed and wired to select and receive *all* localizer and glide slope frequencies.

SECTION II
INSTALLATION

2–1. UNPACKING.

Remove all packing material from the packing case and carefully remove the equipment. Inspect each unit for damage. Be sure all controls on the control unit and the course selector knob on the IN-10 Indicator work properly. Check the units against the packing slip to be sure all items have been received and removed from the packing case.

2–2. PREINSTALLATION TESTS.

Test Equipment. The Type 15F should be bench-tested before installation. The following equipment, or equivalent, is required for the tests:

1. Low-voltage d-c power supply capable of delivering 6 amperes at 14 volts or 3 amperes at 28 volts. The voltage required will depend on the voltage rating of the Type 15F.
2. Headset ARC-11935.
3. ARC Type H-14A Signal Generator with 110.9- and 114.9-mc crystals.
4. Simpson Model 260 Multimeter.
5. Boonton Radio Type 505-B 6-db Attenuator.

Test Procedure.

Step 1. Remove the top cover and bottom and side plates from the receiver. Remove the top cover and bottom plate from the converter.

Step 2. Interconnect the Type 15F units as shown in Figure 2–16 or 2–17. Connect the headset between ground and pin E of J2 on the control unit. Connect pin C of J2 to the primary power.

Step 3. Apply power to the Type 15F and the H-14A Signal Generator and allow a 15-minute warmup period. During the warmup period, check the receiver and converter for lighted tube filaments and the control unit for lighted panel lamps. Check the receiver, converter, control unit, and rack(s) for overheated parts.

Step 4. Unscrew the cover from the auxiliary equipment power connector located on the front panel of the receiver. Connect the multimeter, set to 1000-volt dc range, between ground and wired plug J3. The meter should indicate 260 $\pm$ 10 volts dc.

Step 5. Check the position of the receiver megacycle crystal drum against each setting of the control unit megacycle channel selector switch. The drum position should coincide with the switch position.

Step 6. Repeat Step 5, using the fractional megacycle channel selector switch, and check each fractional megacycle crystal drum position.

Operational Tests.

Step 1. To obtain H-14A hard microvolt readings (refer to *Signal Generator Output* of paragraph 5–5), connect the H-14A RF OUTPUT ATTEN connector through the 6-db attenuator to J1 on the R-34A.

Step 2. Adjust the H-14A controls as outlined in Section II of the H-14A instruction book, then set the controls as follows: OMNI TRACK to 0°, MC to position B (114.9 mc), MODULATION to OMNI, IDENTIFIER to ON, and ATTENUATOR to 5 μv.

Step 3. Set the control unit channel selector switches to 114.90 mc and the SQUELCH control to the maximum counterclockwise position. Turn the VOL control clockwise until the H-14A identification signal is clearly audible.

Step 4. Set the H-14A ATTENUATOR control to 10K μv. Set the ARC Type IN-10 Course Indicator to 0°. The vertical pointer should center, the vertical pointer flag should not be visible, and the to-from meter should indicate TO.

Step 5. Observe the vertical pointer while slowly decreasing the H-14A output to 10 μv. The pointer should not move out of the circle in the center of the IN-10 and the vertical pointer flag should remain hidden.

Step 6. Replace the H-14A "B" crystal (114.9 mc) with a 110.8-mc crystal. Set the control unit channel selector switches to 110.80 mc. Repeat Steps 4 and 5.

Step 7. Set the H-14A MC switch to A (110.9 mc) and the MODULATION switch to AMP LOC (pointer center). Set the ATTENUATOR control to 10K μv.

Step 8. Set the control unit channel selector switches to 110.90 mc. The IN-10 vertical pointer flag should not be visible and the vertical pointer should center.

Step 9. Observe the vertical pointer while slowly decreasing the H-14A output to 10 μv. The pointer should not move out of the circle in the center of the IN-10 and the vertical pointer flag should remain hidden.

Step 10. Set the MODULATION switch to AMP LOC (pointer left). Set the ATTENUATOR control to 1K μv. The vertical pointer should swing to within one pointer width of the outer edge of the blue sector on the IN-10 dial.

Step 11. Set the MODULATION switch to AMP LOC (pointer right). The vertical pointer should swing to within one pointer width of the outer edge of the yellow sector.

Step 12. Loosen the locknut on the R-34A SQUELCH control. Using a screwdriver, rotate the control to the maximum counterclockwise position. Decrease the H-14A output until the receiver is muted. At this point, the output as read on the ATTENUATOR dial should be between 4 and 6 μv.

Note

If remote squelch is used, adjust the remote control rather than the local R-34A control when performing Step 12.

Step 13. Turn off all equipment.

2–3. INSTALLATION CONSIDERATIONS.

The location and installation of the Type 15F will depend on the type of aircraft in which the equipment is installed. Unit installation dimensions are shown in Figures 2–1 through 2–14. Interconnection diagrams for single-unit-rack and dual-unit-rack installations are shown in Figures 2–16 and 2–17. When planning the installation:

1. Compare the installation area under consideration with the dimensions noted on the applicable illustration (Figures 2–1 through 2–14).

2. Locate the units so that they are accessible for inspection and maintenance, and in an area that is free of excessive vibration and heat.

3. Locate the ARC Type C-81A Control Unit and the ARC Type IN-10 Course Indicator at the operator's position. Install the indicator on the shock-mounted instrument panel.

4. Install the units so that they are approximately horizontal when the aircraft is in level flight.

5. Allow sufficient clearance on all sides of each unit for sway, ventilation, and easy removal.

6. Leave sufficient space at the rear of the ARC Type E-14 Rack, or the E-15 and E-16 Racks, to permit cable connections to be made. Also, arrange and size the cabling so as not to restrict shock-mount travel.

7. Do not run cables where they may be subjected to excessively high temperatures, such as may exist adjacent to heaters or exhausts.

8. Do not make sharp bends in cables.

9. Keep coaxial cable as short as possible.

2–4. INSTALLATION.

A-13B Antenna. Installation dimensions for the A-13B Antenna are shown in Figure 2–1. The location and installation of the antenna will depend on the aircraft in which the equipment is installed. Since the final position of the antenna can affect the over-all performance of the Type 15F, observe the following recommendations:

1. Locate the antenna, if possible, at a point where clear line-of-sight area is available.

2. If possible, keep the antenna symmetrical with the centerline of the aircraft.

3. Install the antenna with the glide slope antenna section facing forward.

4. Mount the antenna as far as possible from other antennas on the aircraft. Avoid running lead-in wires or guy wires near the A-13B. Installations where symmetry is maintained with respect to both sides of the antenna will cause the least amount of interaction.

A-17 Antenna Coupler. The general recommendations made with regard to the installation of the A-13B Antenna also apply to the installation of the ARC Type A-17 Antenna Coupler. The antenna required for use with the A-17 is to be furnished by the installing agency. The antenna may be formed of two 26-inch long, 1/16-inch diameter brass rods, fastened on the inside of the canopy in a **V**-shape and located symmetrically with respect to metallic structures when the canopy is closed (see Figure 2–2). The A-17 is installed at the apex of the **V** to permit close connection of the antenna to the A-17 terminals. In piston-type aircraft, the A-17 may be mounted inside near the top of the vertical fin, with beryllium copper rods extending out through insulating grommets to form a 60° **V.** The rods must be placed symmetrically with respect to the vertical fin.

C-81A and C-88A Control Units. Installation dimensions for the C-81A and C-88A Control Units are shown in Figure 2–3. The units are designed for installation on a standard console panel. Each unit is secured by four Dzus fasteners.

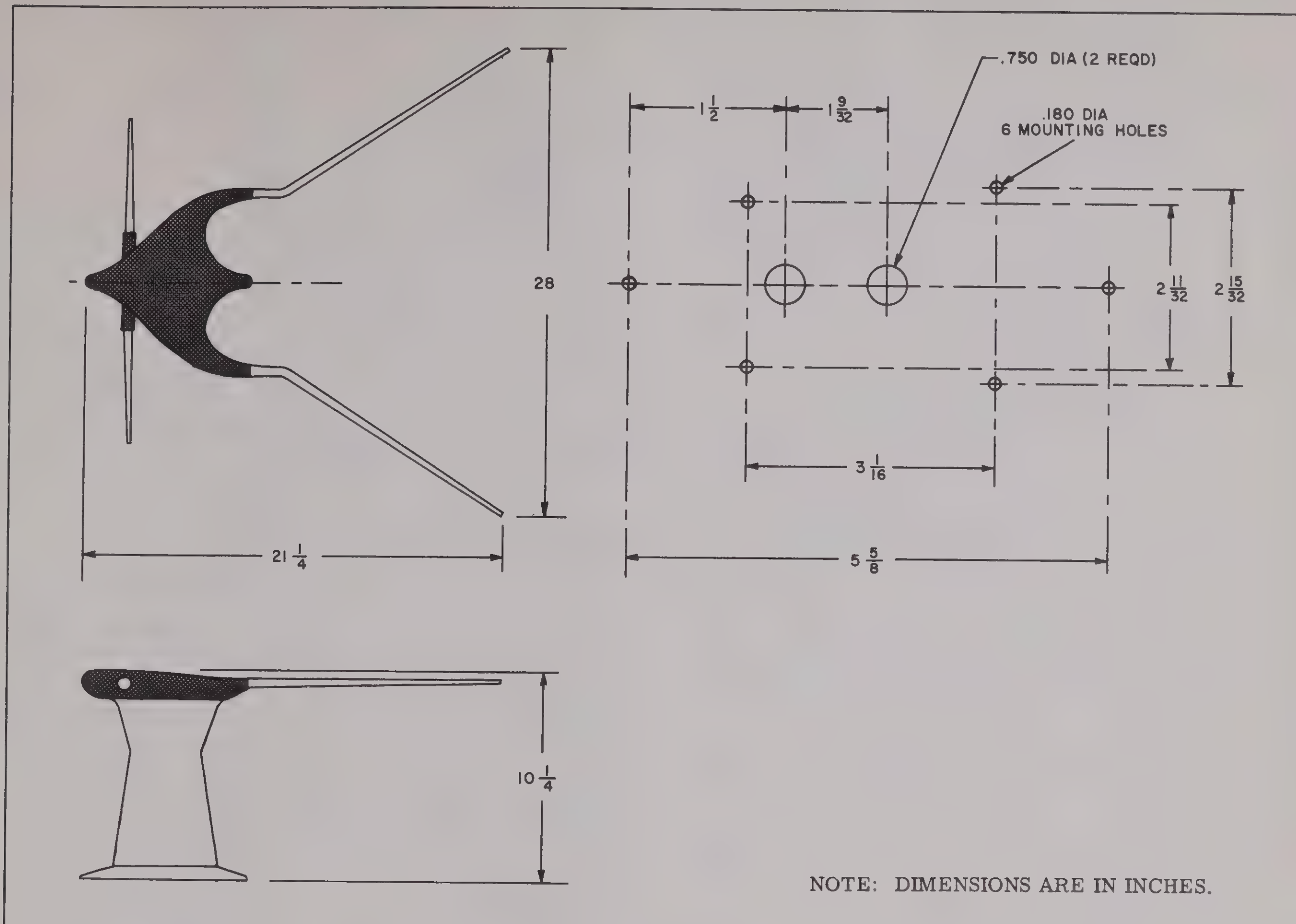
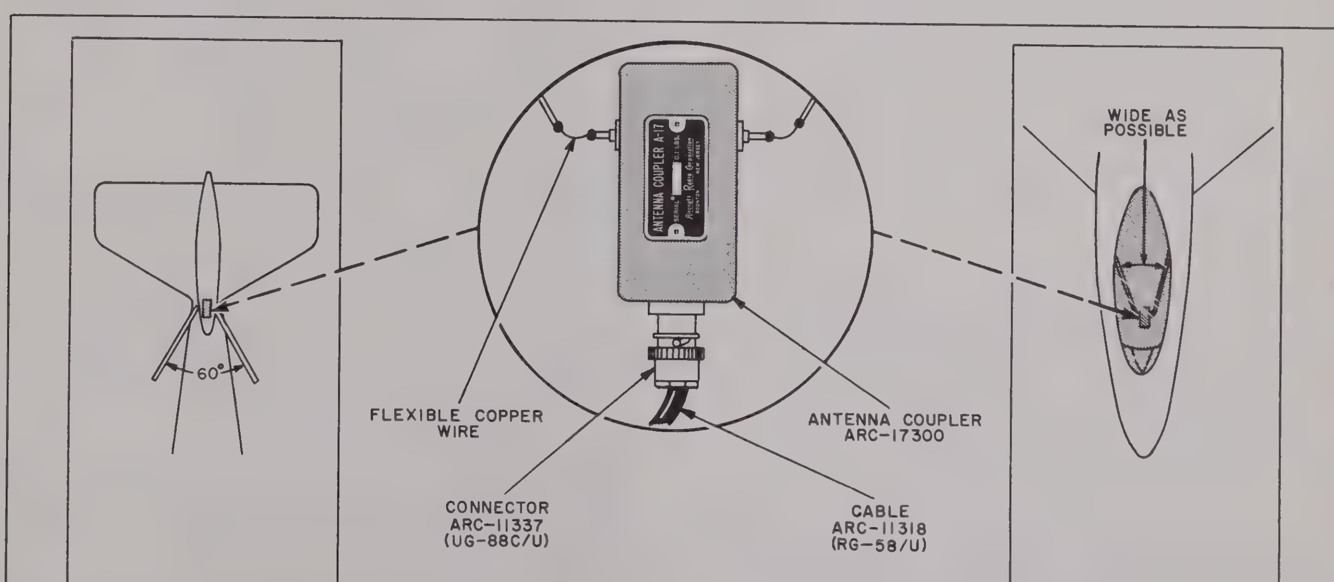


Figure 2–1. A-13B Antenna, Installation Dimensions

TP1347A



NOTES:

1. FOR PISTON-TYPE AIRCRAFT, USE BERYLLIUM COPPER RODS; FOR JET-TYPE AIRCRAFT, USE BRASS RODS.
2. ORIENT ANTENNA ELEMENTS FOR MAXIMUM CLEARANCE.

Figure 2–2. A-17 Antenna Coupler, Installation Diagram

TP1349A

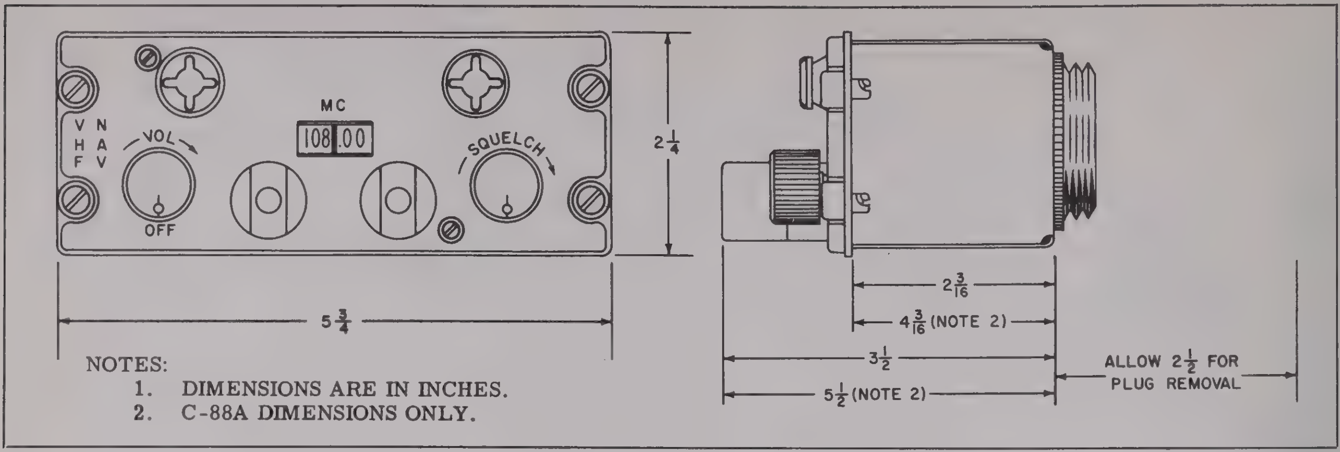


Figure 2–3. C-81A and C-88A Control Units, Installation Dimensions

CC-11A and CC-12A Custom Control Units. Installation information for CC-11A and CC-12A Custom Control Units is given in Figures 2–4 through 2–8. Mounting dimensions and details for the volume control and switch assembly (VOL-OFF), the squelch control (SQUELCH), and the custom control units are shown in Figures 2–4 and 2–5. The method of mounting the custom control unit will vary, depending on the thickness of the metal mounting plate and whether a 3⁄16-inch edge-lighted plastic panel is used in front of the metal panel. Assembly details for the CC-11A are shown in Figure 2–6. This figure is also applicable to the CC-12A. Wiring information for the custom installation is given in Figures 2–7 and 2–8.

M-10 and M-25 Mountings. Installation dimensions for the M-10 and M-25 Mountings are shown in Figures 2–9 and 2–10, respectively. To install either mounting, proceed as follows:

Step 1. Using the mounting as a template for locating the holes, drill the aircraft mounting surface for either four (M-25 Mounting) or eight (M-10 Mounting) No. 10 binding-head screws.

Note

The aircraft mounting surface should be clean, bare metal to insure proper grounding of the unit.

Step 2. Insert the screws through the mounting holes and the two ground straps, and place mounting in position. Secure with nuts and lockwashers.

E-14, E-15, and E-16 Racks. The racks are secured to their respective mountings by four snapslide fasteners. The fasteners engage the grooved studs of the vibration mounts located at the corners of the mounting.

Dynaverter. Four snapslide fasteners are provided for securing the Dynaverter to the grooved studs of the receiver vibration mounts. The Dynaverter must be mounted on these studs so that the polarized three-terminal male connector at the base of the unit will mate with the polarized female connector on the receiver.

Receiver and Converter. Installation dimensions for a dual-unit rack are given in Figure 2–11 and for single-unit racks in Figures 2–12 and 2–13. The racks secure the receiver and the converter by means of nut-and-link arrangements that engage the conical studs mounted on the front of the units. The installation procedure is similar for the single-unit rack and the dual-unit rack. Loosen the knurled thumbnuts until the links point down, slide the receiver or converter, or both, onto the mounting, position the links over the conical studs, and tighten the thumbnuts.

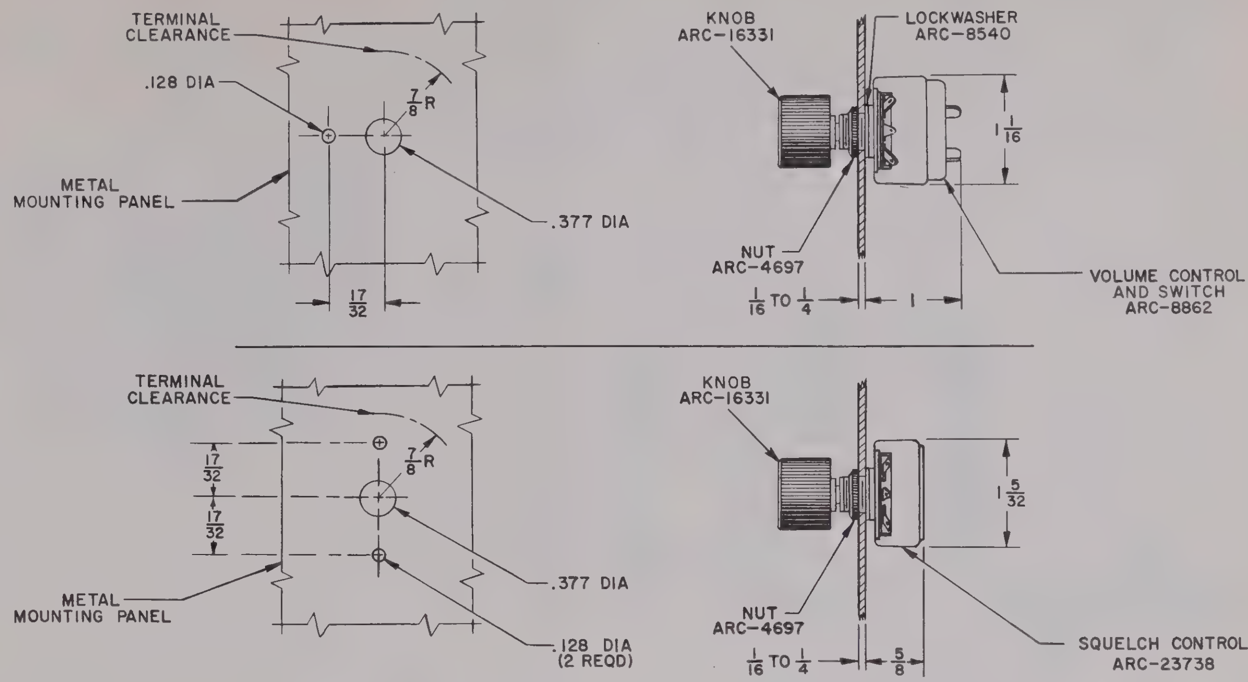
IN-10 and IN-14 Course Indicators. Figure 2–14 shows the installation dimensions for the IN-10 and IN-14 Course Indicators. The indicator used should be installed on a shock-absorbing panel. It may be mounted either from the front or the rear of the panel using the three No. 6-32 screws supplied.

Dual Type 15F Equipment. Procedures for installing the individual units of a dual Type 15F are the same as those described for a single Type 15F, except for the use of a UG-274/U (ARC-14129) **T** antenna adapter on the ANT jack of one receiver. This adapter makes it possible to use one A-13B Antenna for both equipments. Connect the A-13B Antenna to the receivers as follows:

Step 1. Install the **T** adapter on the ANT jack of the receiver closest to the A-13B.

Step 2. Connect the A-13B to the adapter, using ARC-11318 Coaxial Cable cut to a length that is some multiple of an odd quarter wavelength (i.e., 17 inches, 51 inches, 85 inches, etc.).

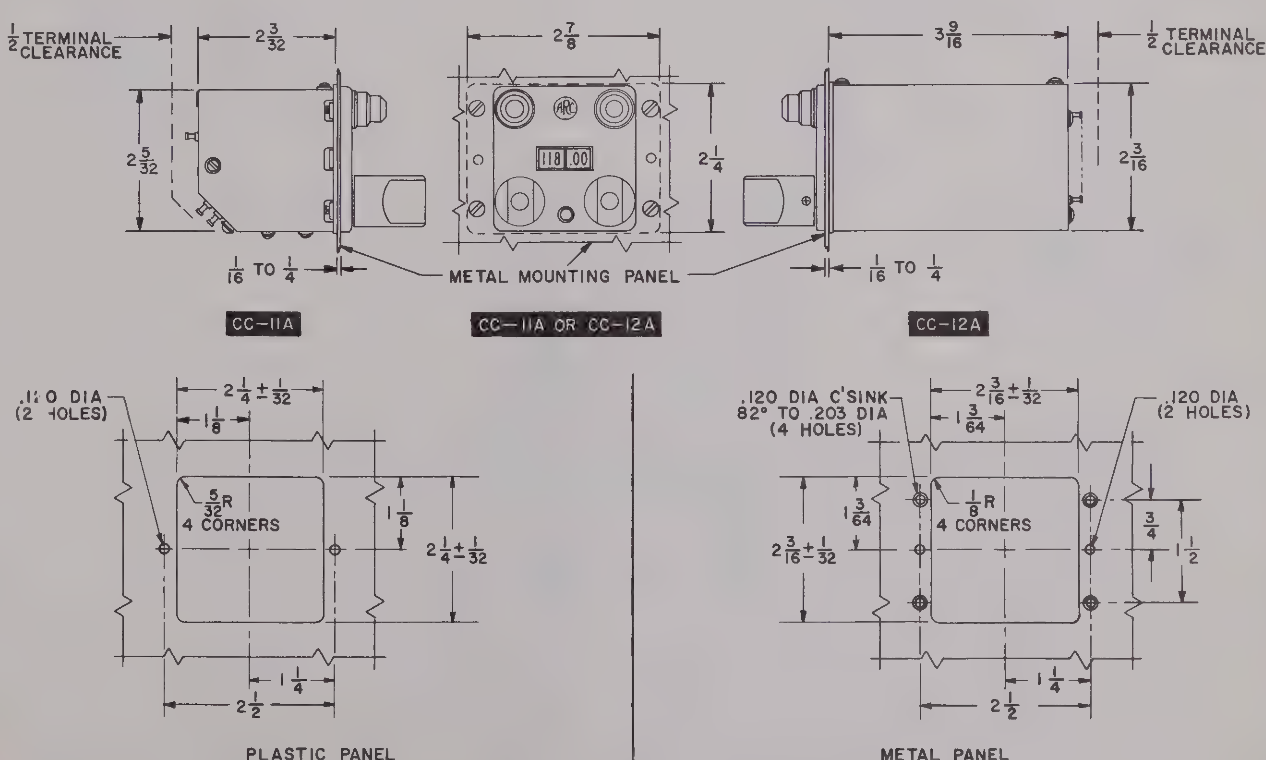
Step 3. Make up a 34½-inch piece of coaxial cable (over-all length including plugs) for connecting the second receiver to the **T** adapter. If this receiver is more than 34½ inches from the adapter, use some multiple of 34½ inches, such as 69 inches, 103½ inches, 138 inches, etc., as required.



NOTE: DIMENSIONS ARE IN INCHES.

TP1785

Figure 2–4. Custom Control Parts, Installation Dimensions



NOTE: DIMENSIONS ARE IN INCHES.

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Figure 2–5. Custom Control Units, Installation Dimensions

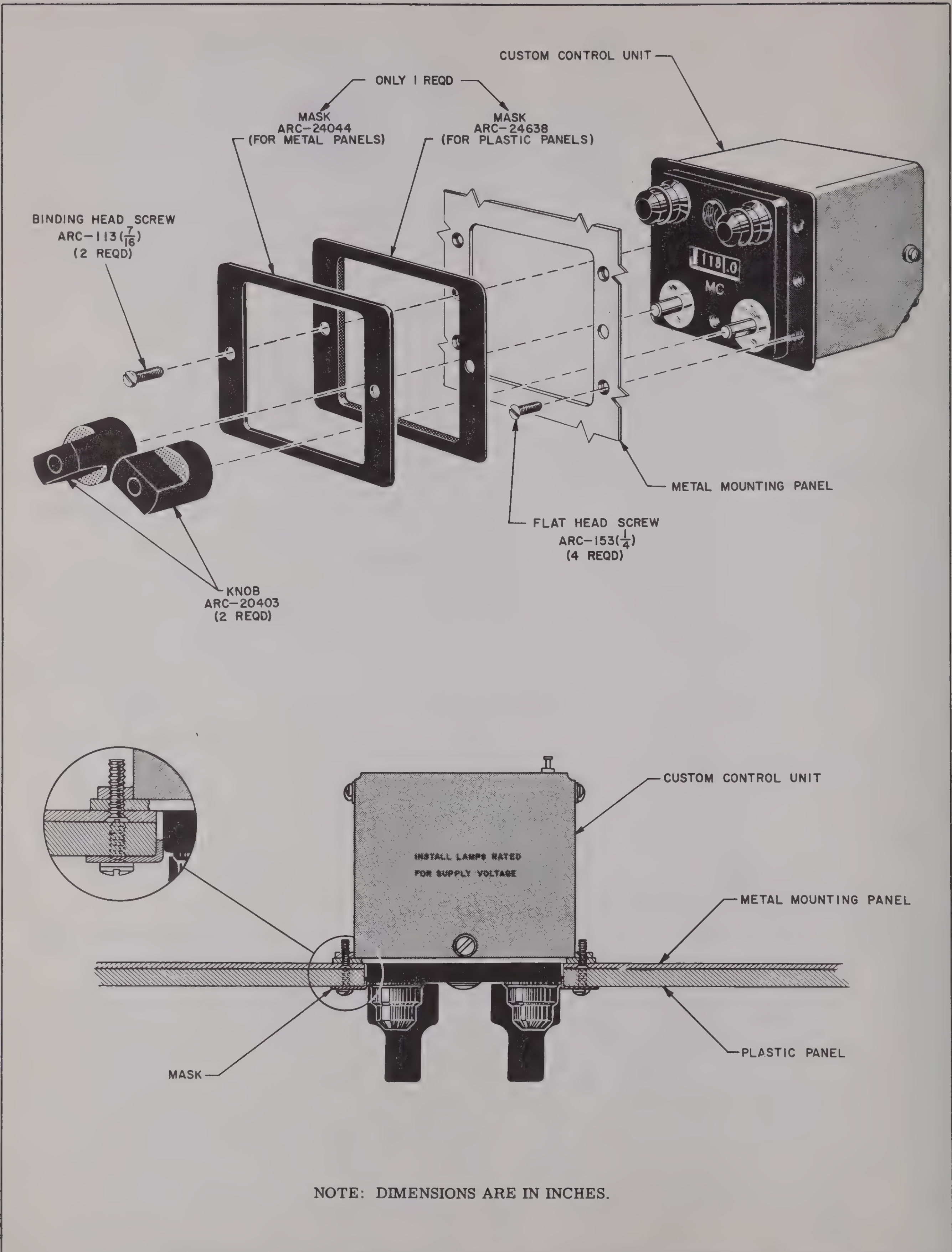
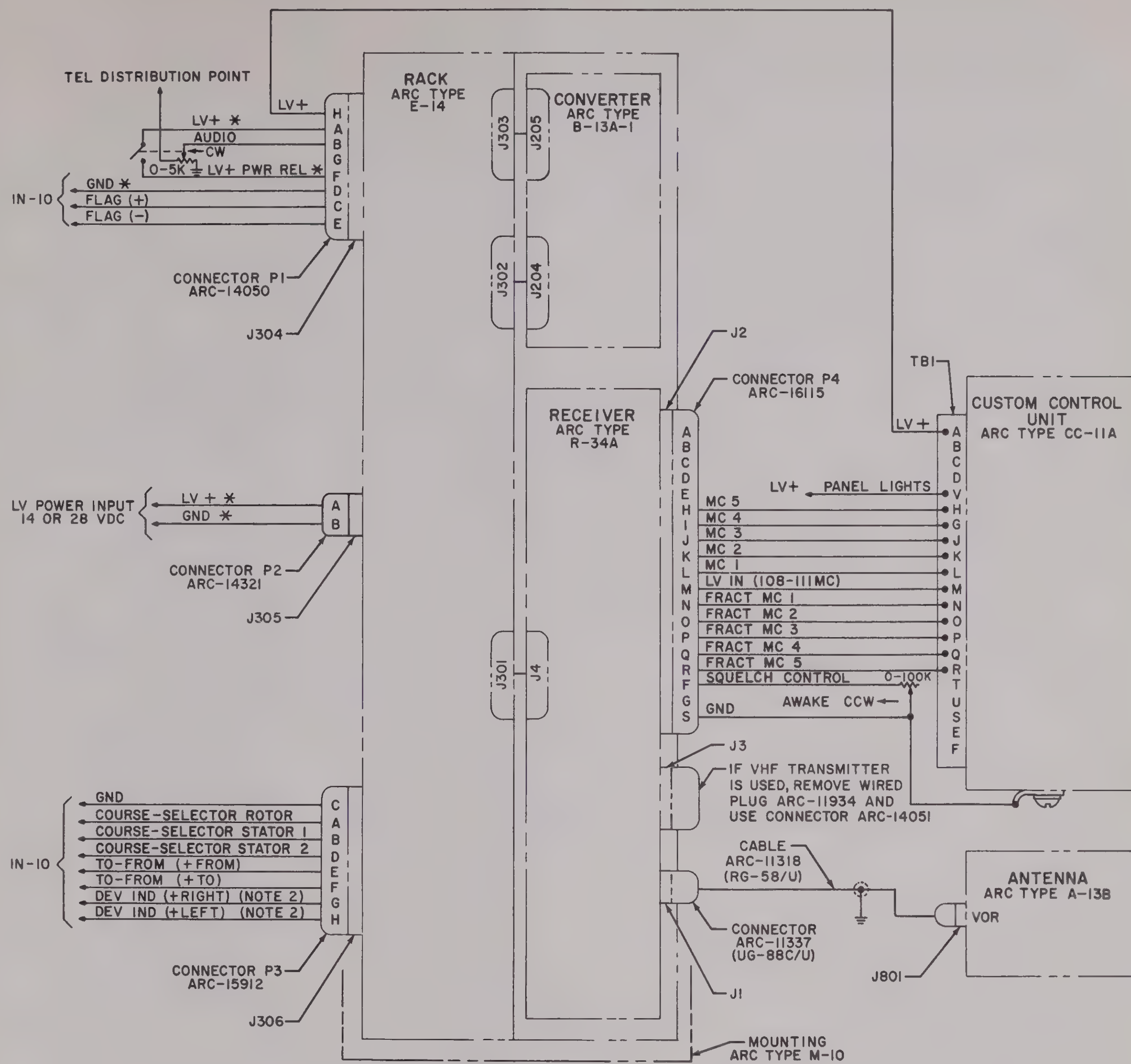


Figure 2–6. CC-11A and CC-12A Custom Control Units, Assembly Details



NOTES:

1. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 16 STRANDED COPPER.

2. THE DEVIATION INDICATOR OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE APPROPRIATE RESISTOR FROM THE RACK.

3. THE FLAG OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE THE APPROPRIATE RESISTOR FROM THE RACK.

4. CONNECTION IS SHOWN FOR REMOTE SQUELCH ONLY.

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Figure 2–7. CC-11A Custom Control Installation, Interconnection Diagram

NOTES:

1. UNMARKED WIRES ARE
FIBROUS-GLASS INSUL
ASTERISK (*) ARE NO.
GLASS INSULATED.

2. CONNECT A 1000-μF D
DEVIATION INDICATO
RECEIVER. THIS CIR
OHM LOADS IN PARAL
SISTANCE IF FEWER

3. THE FLAG OUTPUT
DESIGNED FOR TWO
SHUNT WITH A 1000-
USED.

4. THE DEVIATION IND
RACK IS DESIGNED
ADDITIONAL LOAD
PRIATE RESISTOR

5. THE FLAG OUTPUT
FOR ONE 1000-OHM
PARALLEL, REMO
THE RACK.

6. THE R-34A IS SHOW
ONLY.

7. RESISTANCE VALU

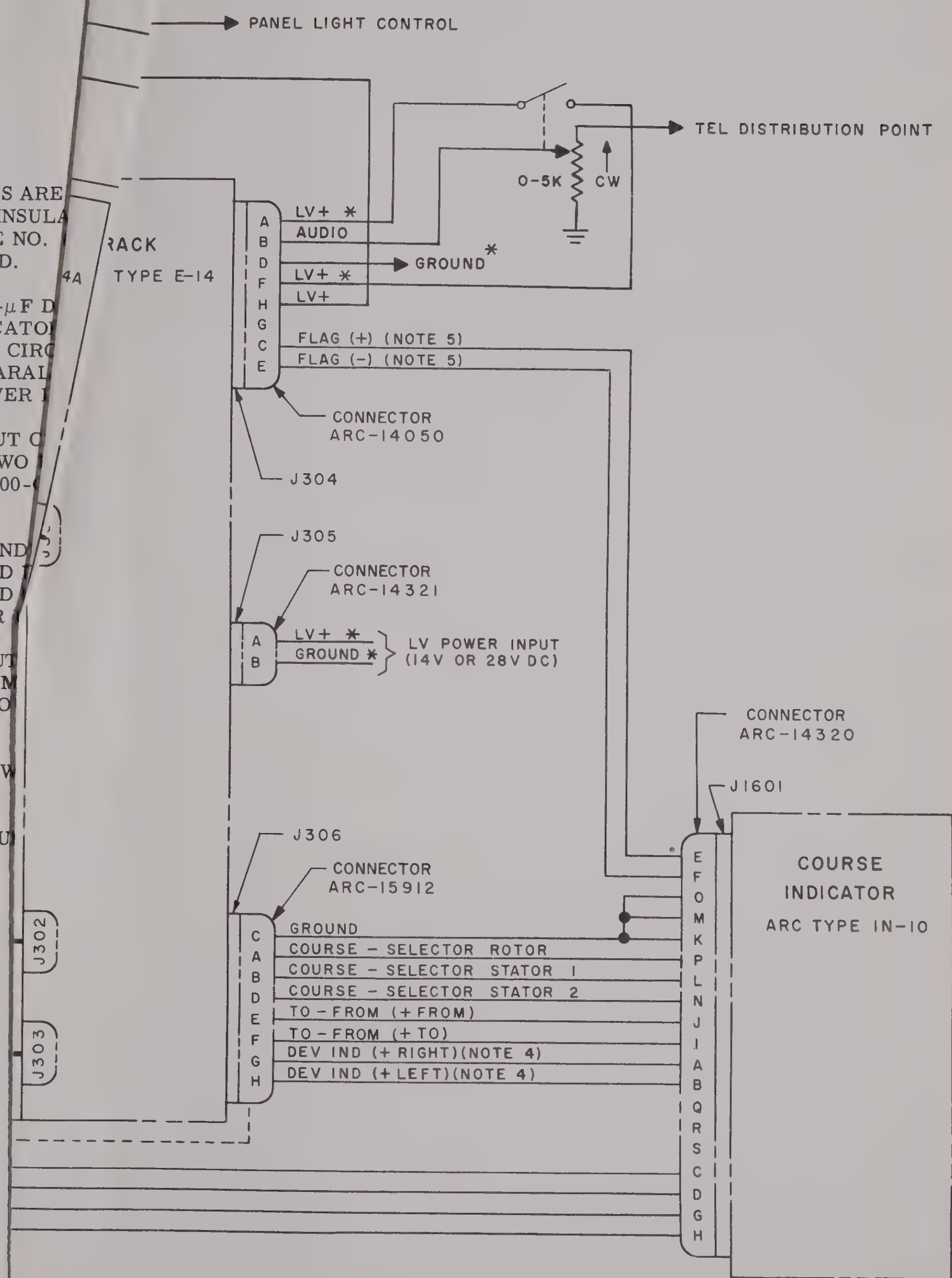


Figure 2–8. CC-12A Custom Control Installation, Interconnection Diagram

NOTES:

1. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 16 STRANDED COPPER, FIBROUS-GLASS INSULATED.

2. CONNECT A 1000-μF DAMPING CAPACITOR ACROSS THE DEVIATION INDICATOR OUTPUT CIRCUIT OF THE R-31A RECEIVER. THIS CIRCUIT IS DESIGNED FOR THREE 1000-OHM LOADS IN PARALLEL. SHUNT WITH SUITABLE RESISTANCE IF FEWER LOADS ARE USED.

3. THE FLAG OUTPUT CIRCUIT OF THE R-31A RECEIVER IS DESIGNED FOR TWO 1000-OHM METER LOADS IN PARALLEL. SHUNT WITH A 1000-OHM RESISTOR IF ONLY ONE METER IS USED.

4. THE DEVIATION INDICATOR OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE THE APPROPRIATE RESISTOR FROM THE RACK.

5. THE FLAG OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE THE APPROPRIATE RESISTOR FROM THE RACK.

6. THE R-34A IS SHOWN CONNECTED FOR LOCAL SQUELCH ONLY.

7. RESISTANCE VALUE IS IN OHMS; MULTIPLIER K=1000.

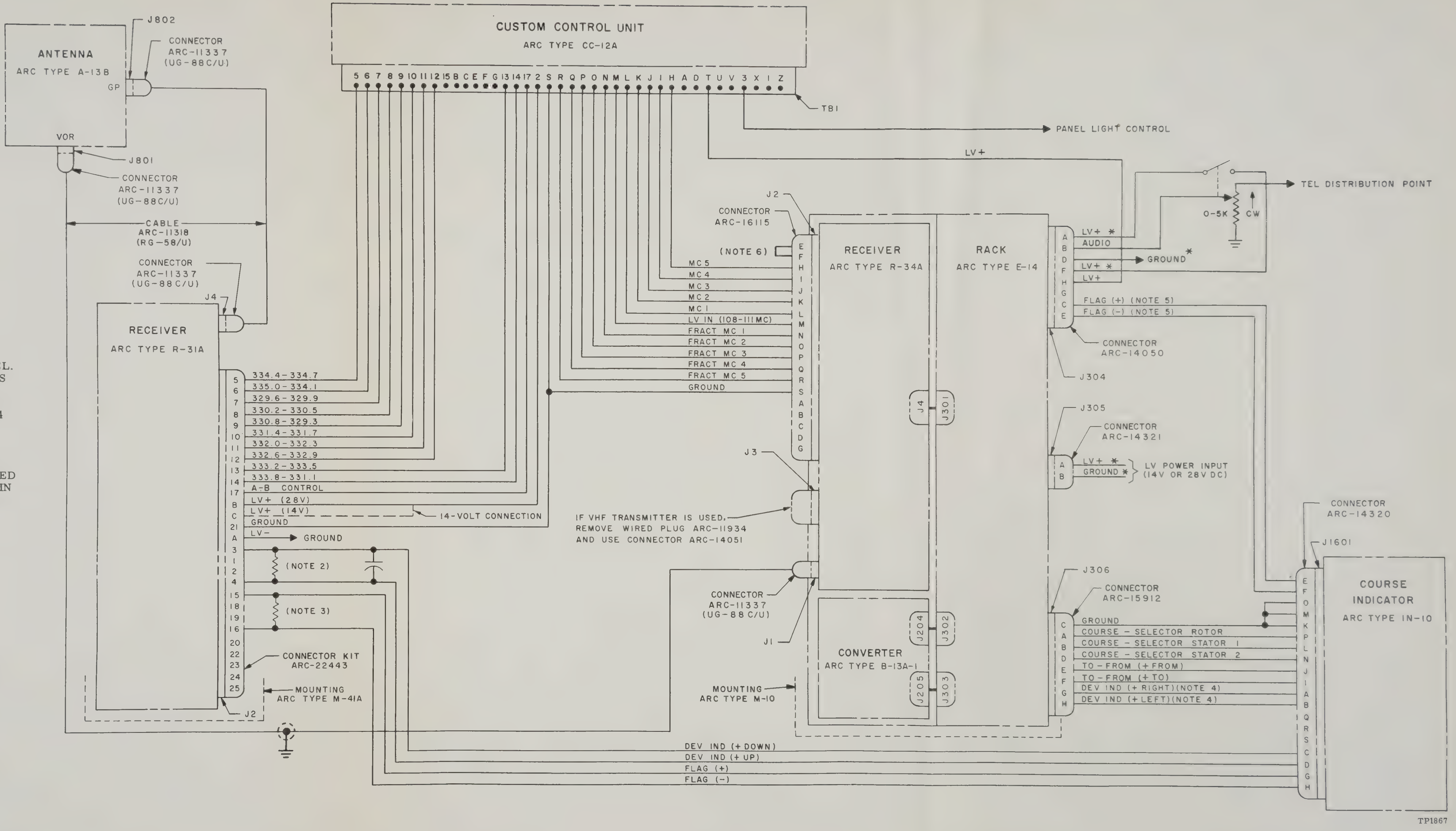


Figure 2–8. CC-12A Custom Control Installation, Interconnection Diagram

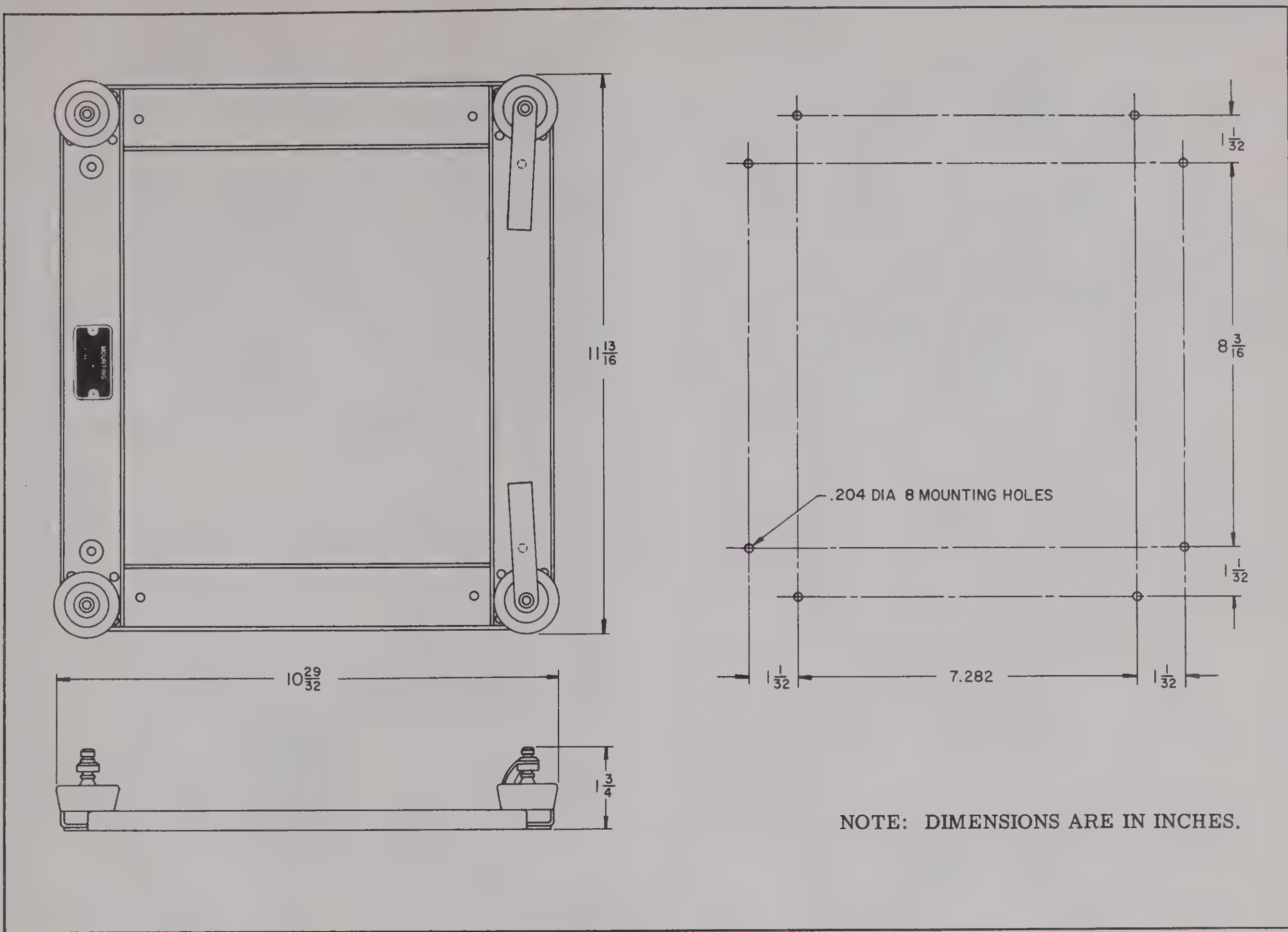


Figure 2–9. M-10 Mounting, Installation Dimensions

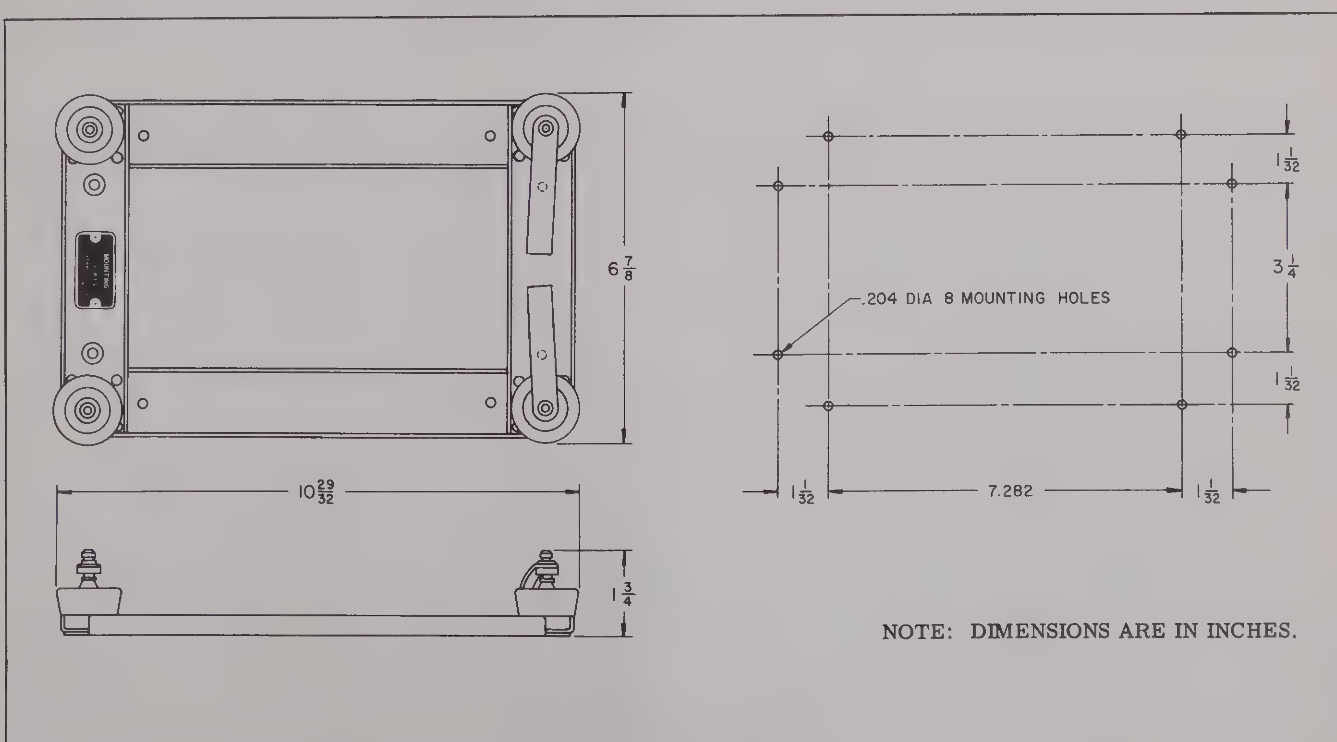
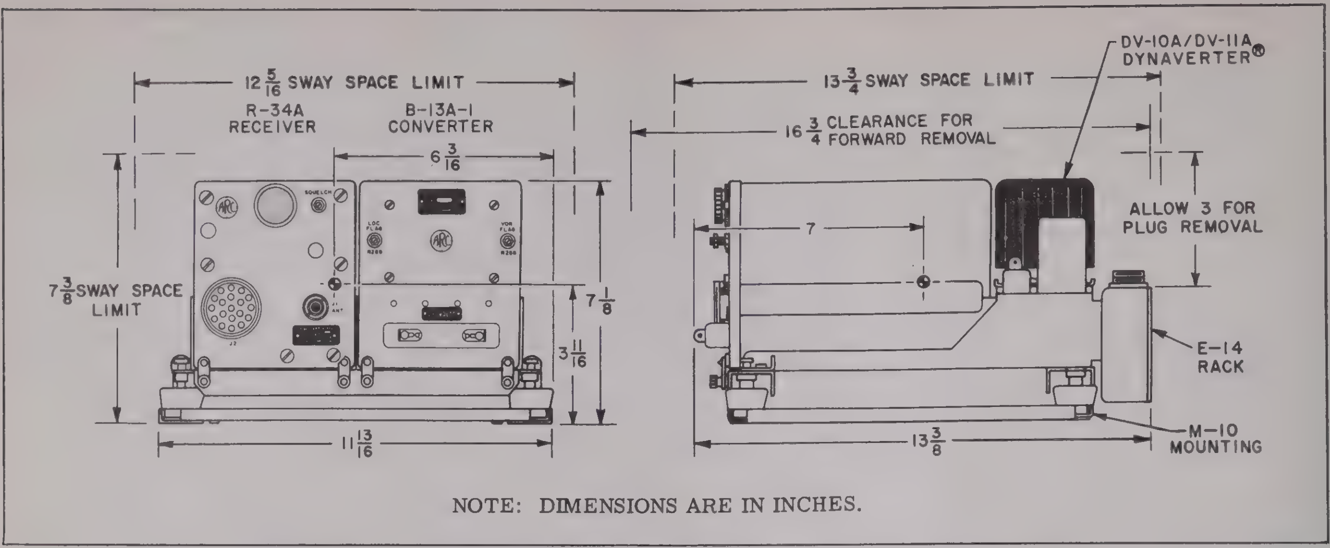
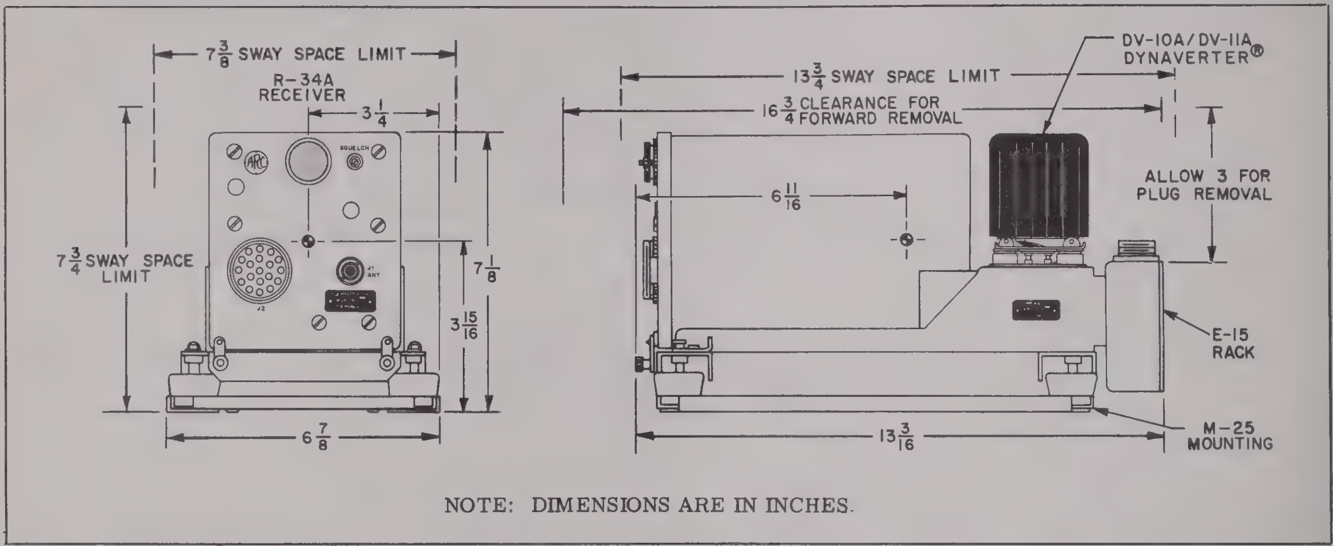


Figure 2–10. M-25 Mounting, Installation Dimensions



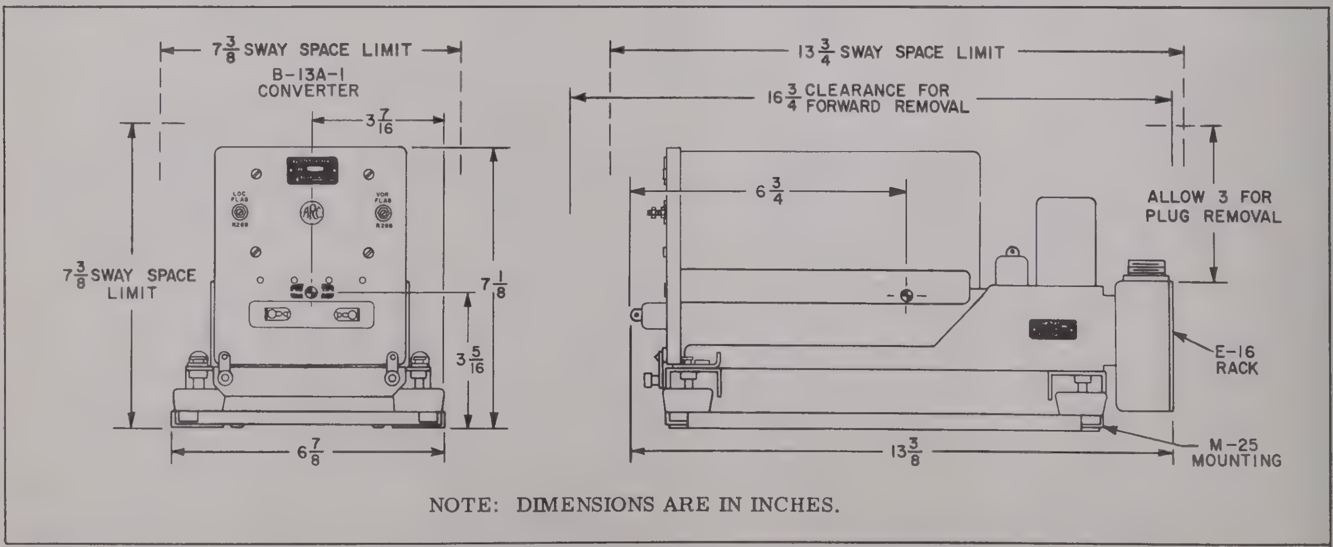
TP1339A

Figure 2–11. E-14 Rack and M-10 Mounting, Installation Dimensions



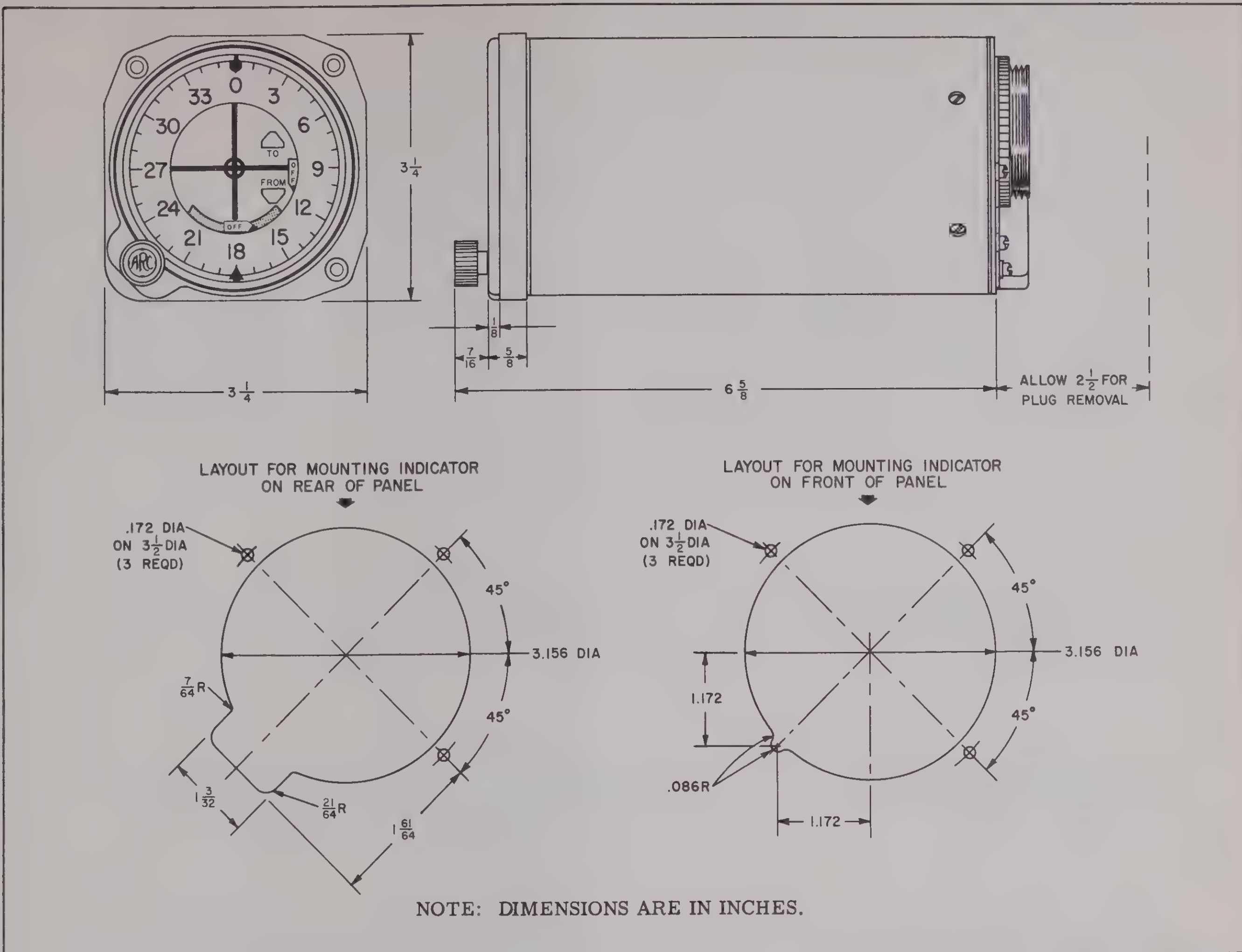
TP1335A

Figure 2–12. E-15 Rack and M-25 Mounting, Installation Dimensions



TP1337A

Figure 2–13. E-16 Rack and M-25 Mounting, Installation Dimensions



TP1341A

Figure 2–14. IN-10 and IN-14 Course Indicators, Installation Dimensions

2–5. CABLE FABRICATION.

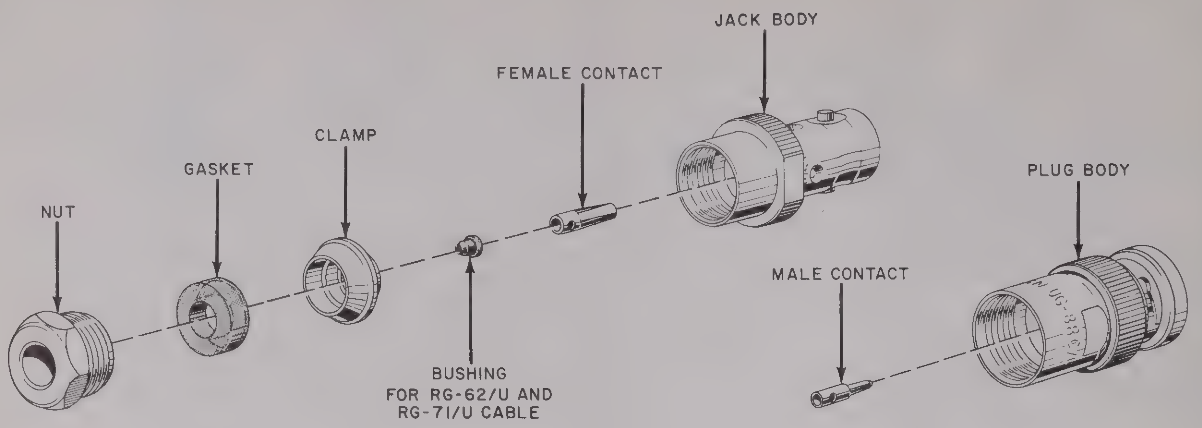
The connectors required for fabricating interconnecting cables for the Type 15F are supplied, but the individual wires are not. Open-wire cables are recommended for flexibility and for ease of construction and maintenance. The size and number of conductors and their terminations are shown in Figures 2–16 and 2–17. The final length of each cable assembly will depend on the location of the equipment in the aircraft. Instructions for fabricating the antenna cable assembly are given in Figure 2–15.

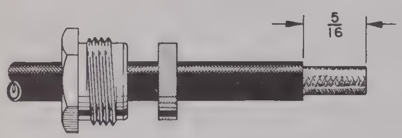
2–6. INTERCONNECTION OF UNITS.

Type 15F Units. Interconnection diagrams for dual-unit-rack and single-unit-rack installations are shown in Figures 2–16 and 2–17, respectively. After the interconnecting cables are fabricated, check the wires of each cable with an ohmmeter for shorts, opens, and high-resistance junctions before connecting the low-voltage power supply.

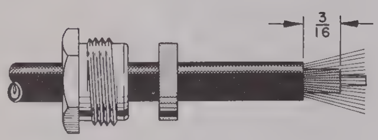
Type 15F and Associated Units. The Type 15F may be used with the ARC Type T-25A Transmitter to form a supplementary vhf system and with the ARC Type R-31A Glide Slope Receiver to supply the pilot with vertical as well as lateral guidance during landings. Figure 2–18 shows a typical installation of the Type 15F and T-25A. In this installation, an ARC Type C-82A Control Unit is used to operate the transmitter, and an ARC Type C-81A Control Unit is used to operate the Type 15F and control the LV+ power distribution to all units. Only Type 15F circuits that are used with the T-25A are shown in the illustration. Complete interconnection diagrams for the Type 15F are given in Figures 2–16 and 2–17. For further transmitter information, refer to the instruction book for the ARC Type T-25A Transmitter.

Figure 2–19 shows a typical installation of the R-31A and the Type 15F. The ARC Type C-88A Control Unit is used in place of the C-81A to control both the glide slope receiver and the Type 15F units. For further details, refer to the instruction book for the ARC Type R-31A Glide Slope Receiver.

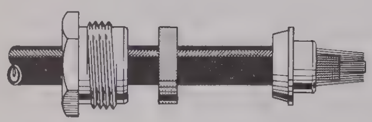




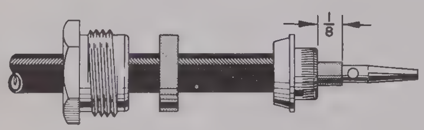
PLACE NUT AND GASKET OVER CABLE AND TRIM JACKET TO DIMENSION SHOWN. UNGROOVED FACE OF GASKET MUST BE TOWARD NUT.



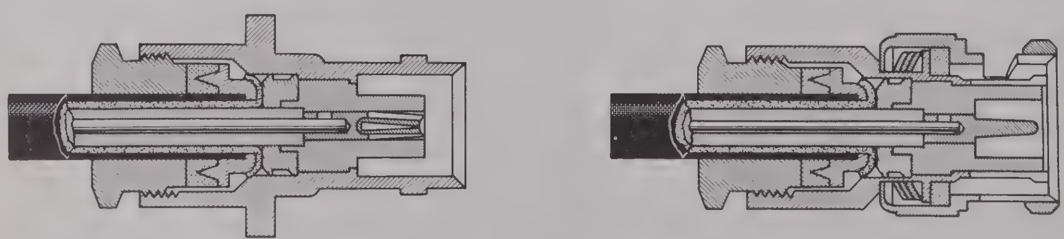
COMB OUT BRAID AND CUT CABLE DIELECTRIC TO DIMENSION SHOWN, BEING CAREFUL NOT TO NICK CENTER CONDUCTOR. TIN CENTER CONDUCTOR.



PULL BRAID WIRES FORWARD AND TAPER TOWARD CENTER CONDUCTOR. PLACE CLAMP OVER BRAID AND PUSH AGAINST CABLE JACKET.



FOLD BACK BRAID WIRES AS SHOWN, TRIM TO PROPER LENGTH, AND FORM OVER CLAMP AS SHOWN. FOR RG-62/U AND RG-71/U CABLE, SLIP BUSHING OVER CENTER CONDUCTOR AND UNDER DIELECTRIC. SOLDER CONTACT TO CENTER CONDUCTOR.



INSERT CABLE AND PARTS INTO CONNECTOR BODY. MAKE SURE SHARP EDGE OF CLAMP SEATS PROPERLY IN GASKET. TIGHTEN NUT.

Figure 2–15. Fabrication of Antenna Cable Assembly

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NOTES:

1. FOR PROPER
AIRCRAFT SU
BARE METAI
POINTS.

2. UNMARKED V
COPPER, FII
WIRES MARK
ARE NO. 16 S

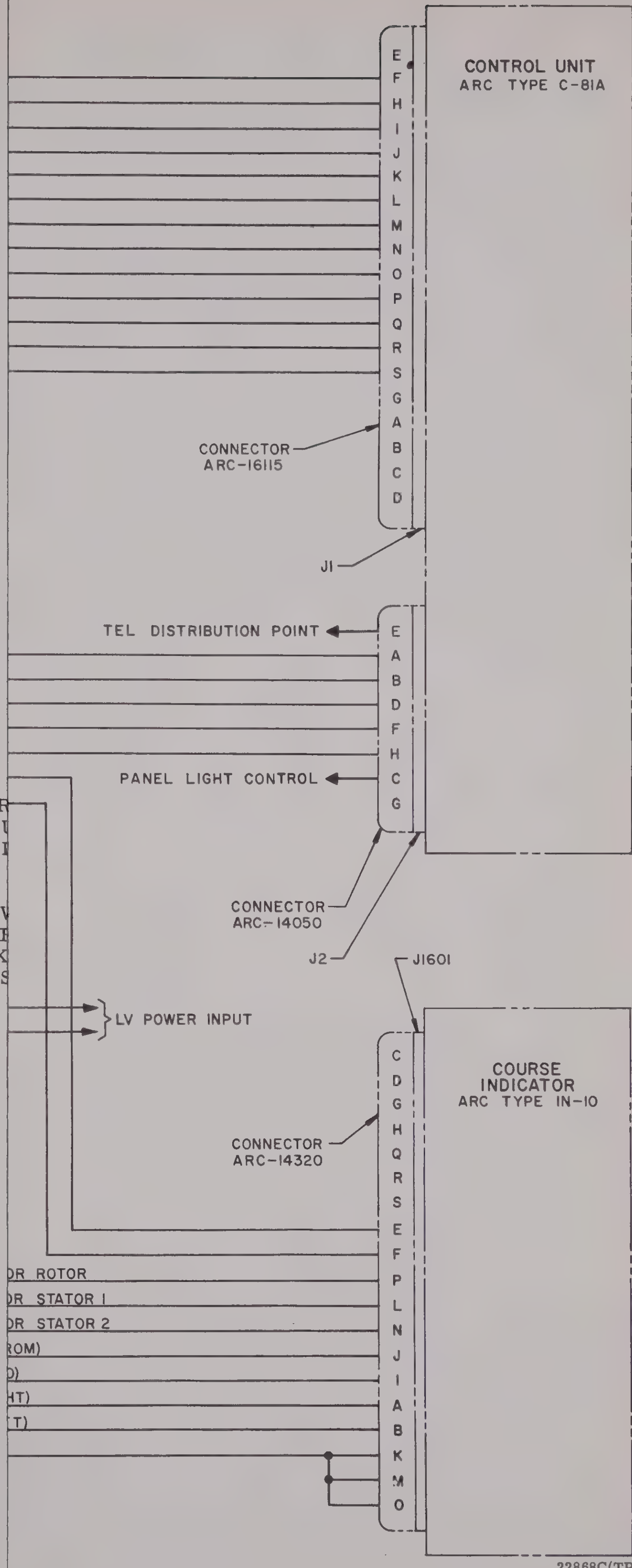
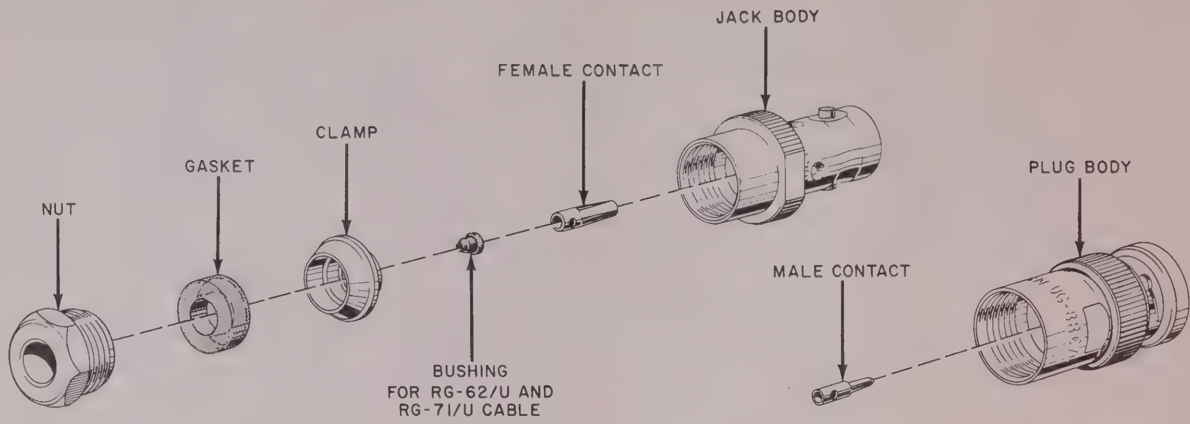
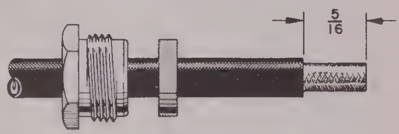
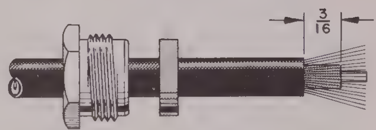


Figure 2–16. Dual-unit-rack Installation, Interconnection Diagram

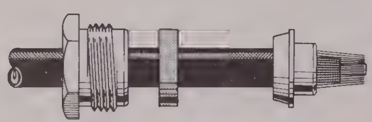




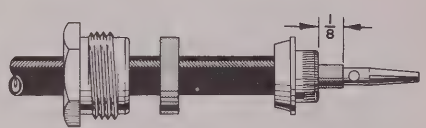
PLACE NUT AND GASKET OVER CABLE AND TRIM JACKET TO DIMENSION SHOWN. UNGROOVED FACE OF GASKET MUST BE TOWARD NUT.



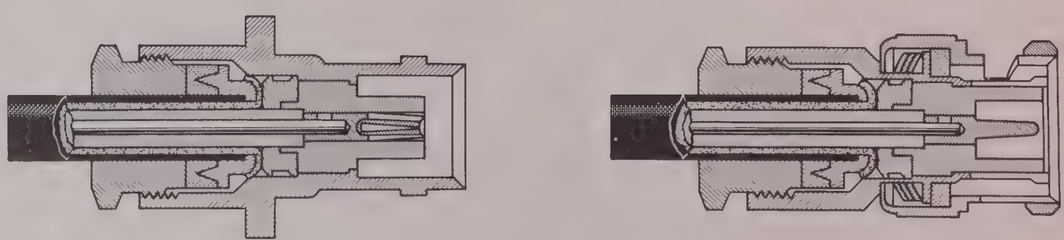
COMB OUT BRAID AND CUT CABLE DIELECTRIC TO DIMENSION SHOWN, BEING CAREFUL NOT TO NICK CENTER CONDUCTOR. TIN CENTER CONDUCTOR.



PULL BRAID WIRES FORWARD AND TAPER TOWARD CENTER CONDUCTOR. PLACE CLAMP OVER BRAID AND PUSH AGAINST CABLE JACKET.



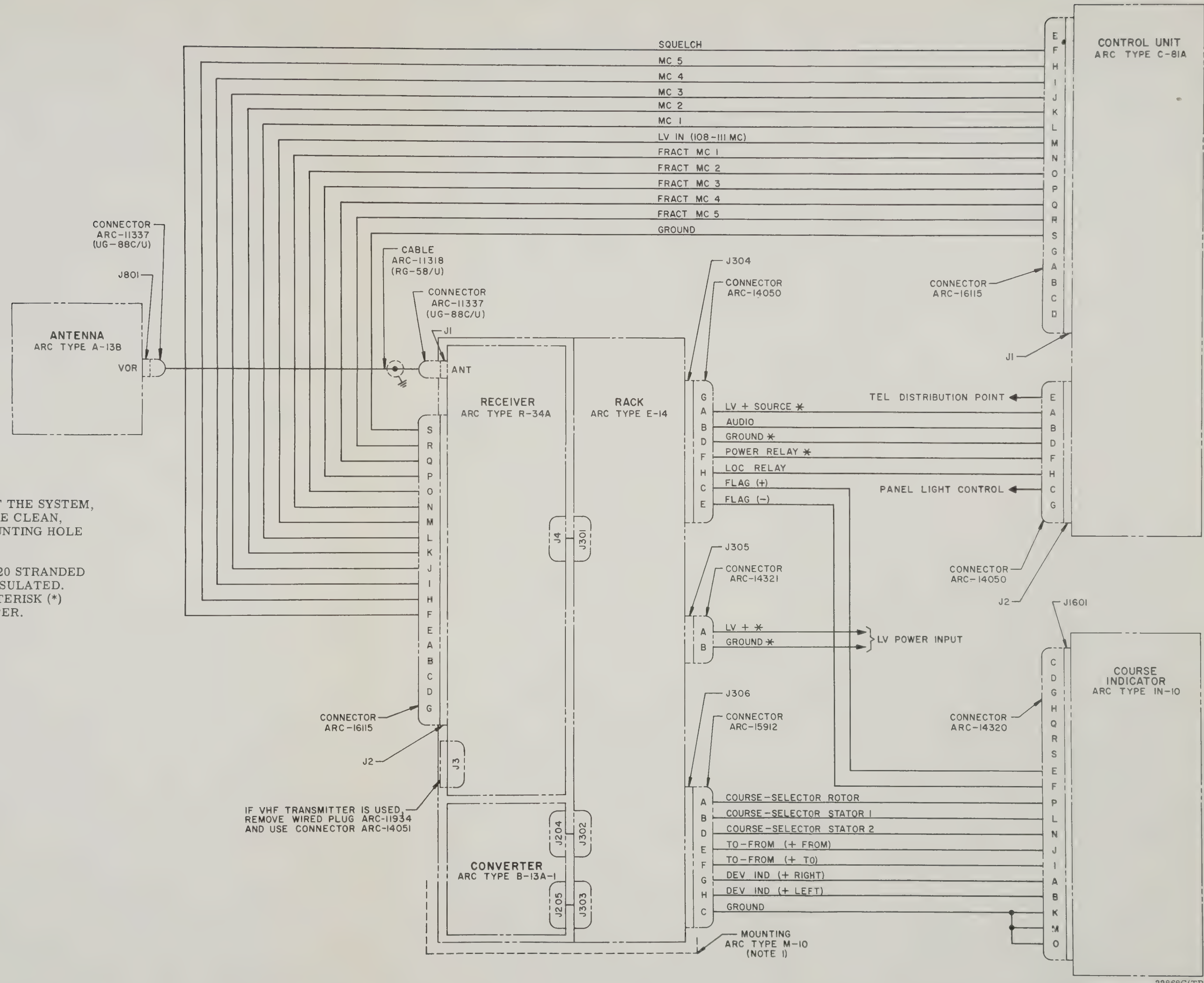
FOLD BACK BRAID WIRES AS SHOWN, TRIM TO PROPER LENGTH, AND FORM OVER CLAMP AS SHOWN. FOR RG-62/U AND RG-71/U CABLE, SLIP BUSHING OVER CENTER CONDUCTOR AND UNDER DIELECTRIC. SOLDER CONTACT TO CENTER CONDUCTOR.



INSERT CABLE AND PARTS INTO CONNECTOR BODY. MAKE SURE SHARP EDGE OF CLAMP SEATS PROPERLY IN GASKET. TIGHTEN NUT.

Figure 2–15. Fabrication of Antenna Cable Assembly

TP1731

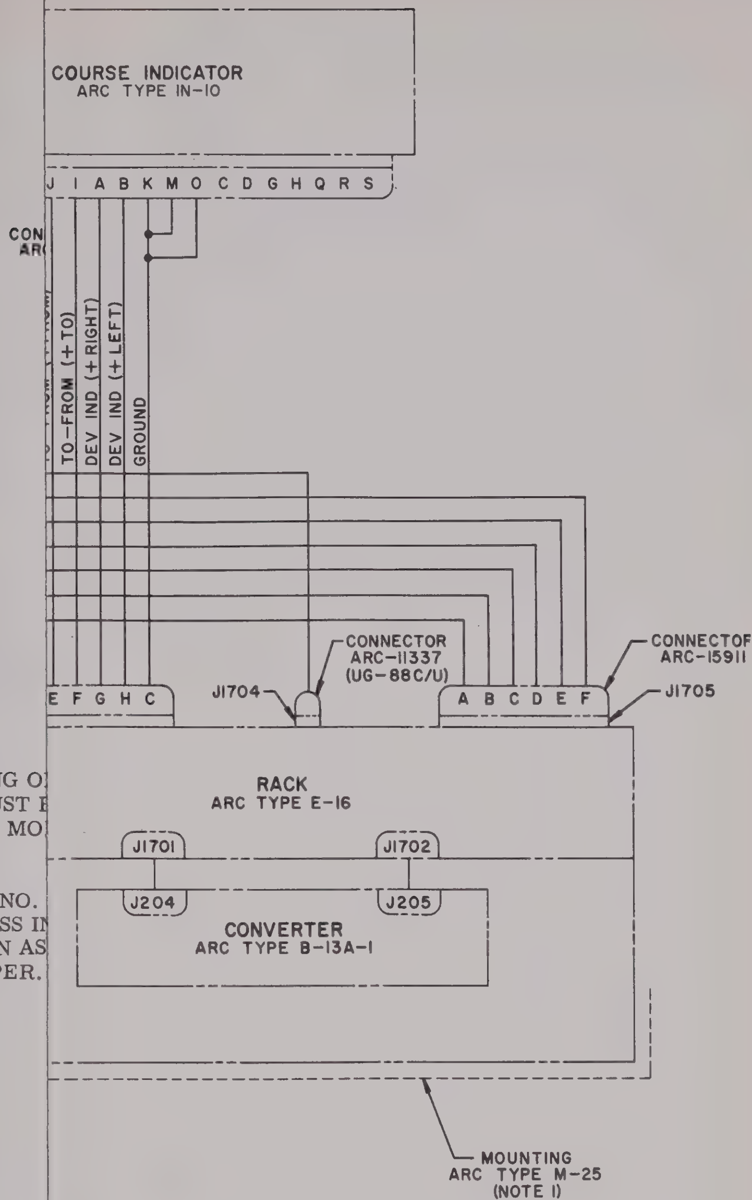


NOTES:

1. FOR PROPER GROUNDING OF THE SYSTEM, AIRCRAFT SURFACE MUST BE CLEAN, BARE METAL AT EIGHT MOUNTING HOLE POINTS.

2. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 16 STRANDED COPPER.

Figure 2–16. Dual-unit-rack Installation, Interconnection Diagram



NOTES:

1. FOR PROPER GROUNDING O
AIRCRAFT SURFACE MUST I
BARE METAL AT EIGHT MO
POINTS.

2. UNMARKED WIRES ARE NO.
COPPER, FIBROUS-GLASS I
WIRES MARKED WITH AN AS
NO. 16 STRANDED COPPER.

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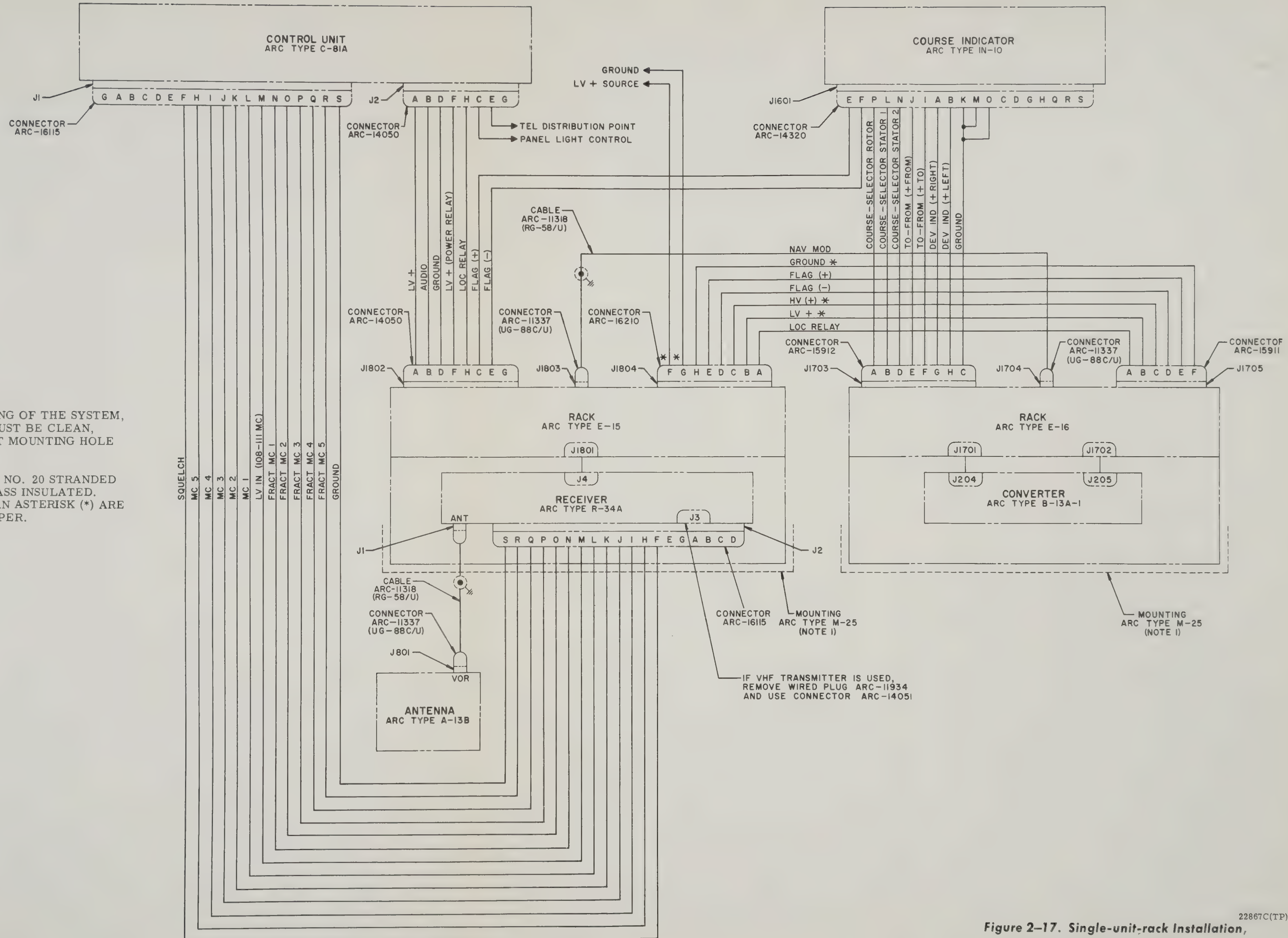
Figure 2–17. Single-unit-rack Installation, Interconnection Diagram



NOTES:

1. FOR PROPER GROUNDING OF THE SYSTEM, AIRCRAFT SURFACE MUST BE CLEAN, BARE METAL AT EIGHT MOUNTING HOLE POINTS.
2. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 16 STRANDED COPPER.

22867C(TP)

Figure 2–17. Single-unit-rack Installation, Interconnection Diagram

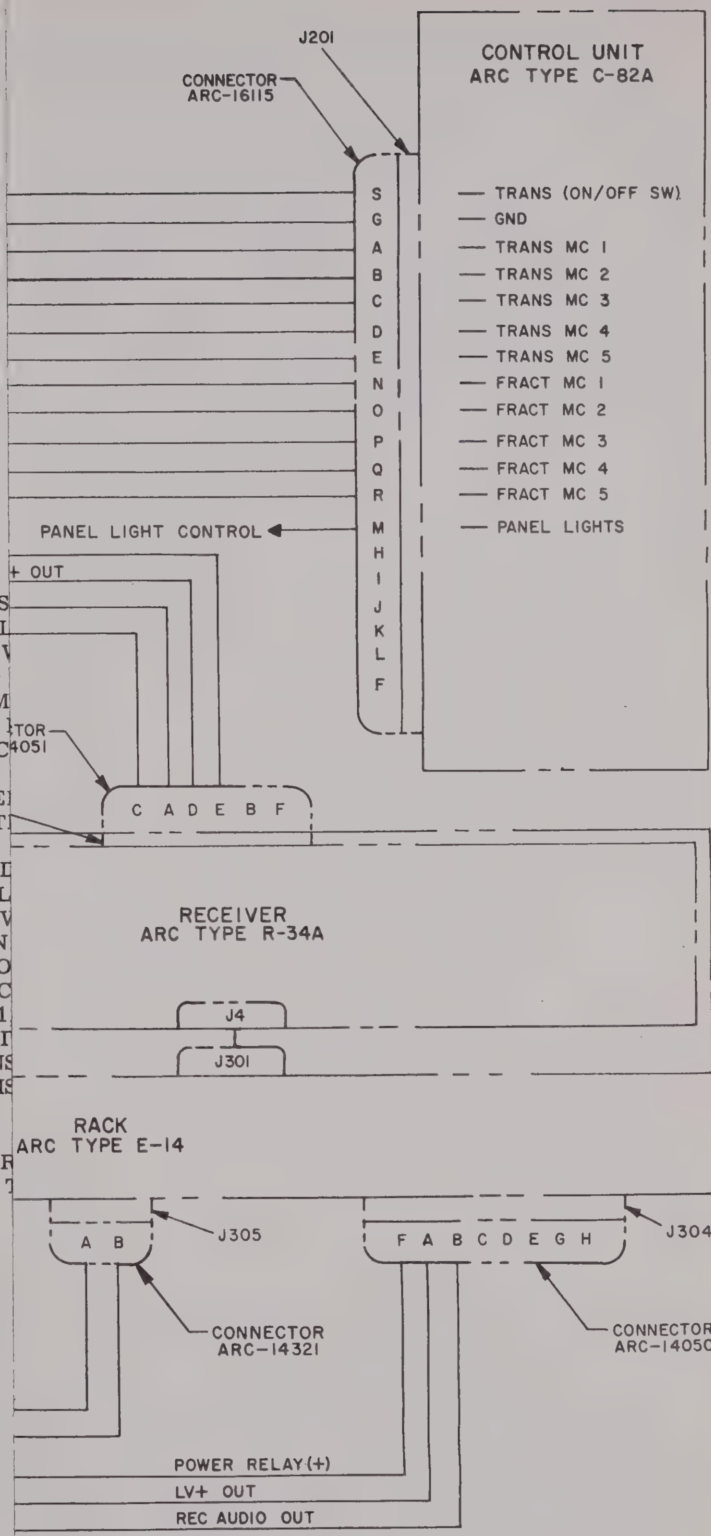
NOTES:

1. UNMARKED WIRES ARE NO. 20 S
COPPER, FIBROUS-GLASS INSUL
SHIELDED WIRES ARE NO. 20. V
MARKED WITH AN ASTERISK (*)
SUFFICIENT SIZE (NO. 16 MINIM
PROVIDE LESS THAN 0.5-VOLT
TWEEN EQUIPMENT AND SOURC

2. A 15-AMPERE CIRCUIT BREAKE
OMMENDED FOR CIRCUIT PROT

3. CONNECTIONS SHOWN ARE USED
RECEIVER DYNAVERTER SUPPL
VOLTAGE TO THE T-25A. IF DV
DYNAVERTER IS INSTALLED ON
(1) DO NOT INTERCONNECT J3 O
AND J111 OF T-25A, (2) CONNEC
BETWEEN PINS 5 AND 7 OF J111
NECT PIN C OF J111 TO NEGATI
NAL OF LV SUPPLY, AND (4) INS
WIRED PLUG ARC-11934 (FURNIS
R-34A) ON J3.

4. SEE FIGURES 2-16 AND 2-17 FOR
INSTALLATION DIAGRAMS FOR T
EQUIPMENT.



23637A(TP)

Figure 2–18. Type 15F and T-25A Transmitter, Interconnection Diagram

NOTES:

1. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. SHIELDED WIRES ARE NO. 20. WIRES MARKED WITH AN ASTERISK (*) ARE OF SUFFICIENT SIZE (NO. 16 MINIMUM) TO PROVIDE LESS THAN 0.5-VOLT DROP BETWEEN EQUIPMENT AND SOURCE.

2. A 15-AMPERE CIRCUIT BREAKER IS RECOMMENDED FOR CIRCUIT PROTECTION.

3. CONNECTIONS SHOWN ARE USED WHEN RECEIVER DYNAVERTER SUPPLIES HIGH VOLTAGE TO THE T-25A. IF DV-12A DYNAVERTER IS INSTALLED ON THE T-25A: (1) DO NOT INTERCONNECT J3 OF R-34A AND J111 OF T-25A, (2) CONNECT JUMPER BETWEEN PINS 5 AND 7 OF J111, (3) CONNECT PIN C OF J111 TO NEGATIVE TERMINAL OF LV SUPPLY, AND (4) INSTALL WIRED PLUG ARC-11934 (FURNISHED WITH R-34A) ON J3.

4. SEE FIGURES 2-16 AND 2-17 FOR COMPLETE INSTALLATION DIAGRAMS FOR TYPE 15F EQUIPMENT.

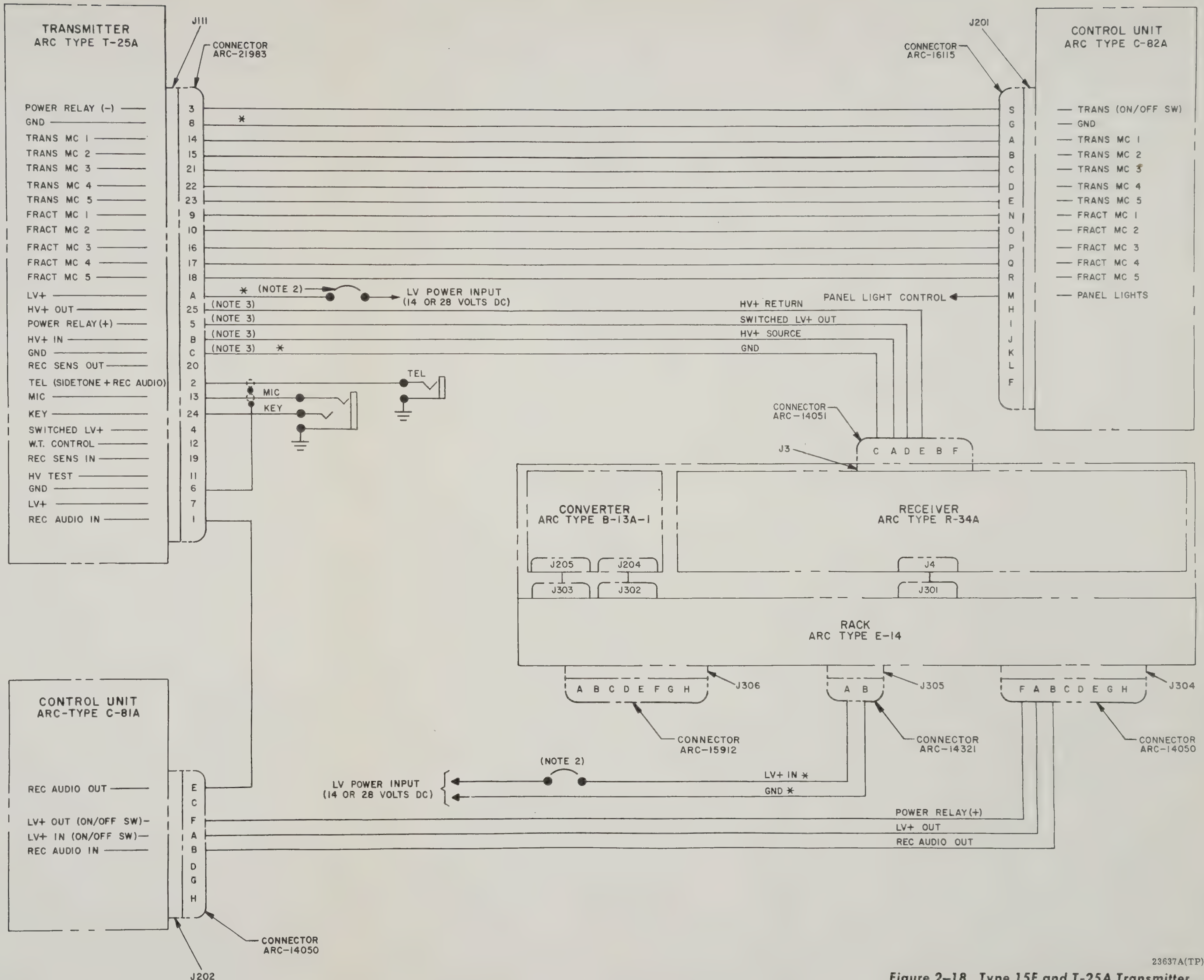


Figure 2–18. Type 15F and T-25A Transmitter, Interconnection Diagram

NOTES:

1. U C W N G

2. C A P T 1 W L

3. T R O W M

4. T C O T A

5. T R L P R

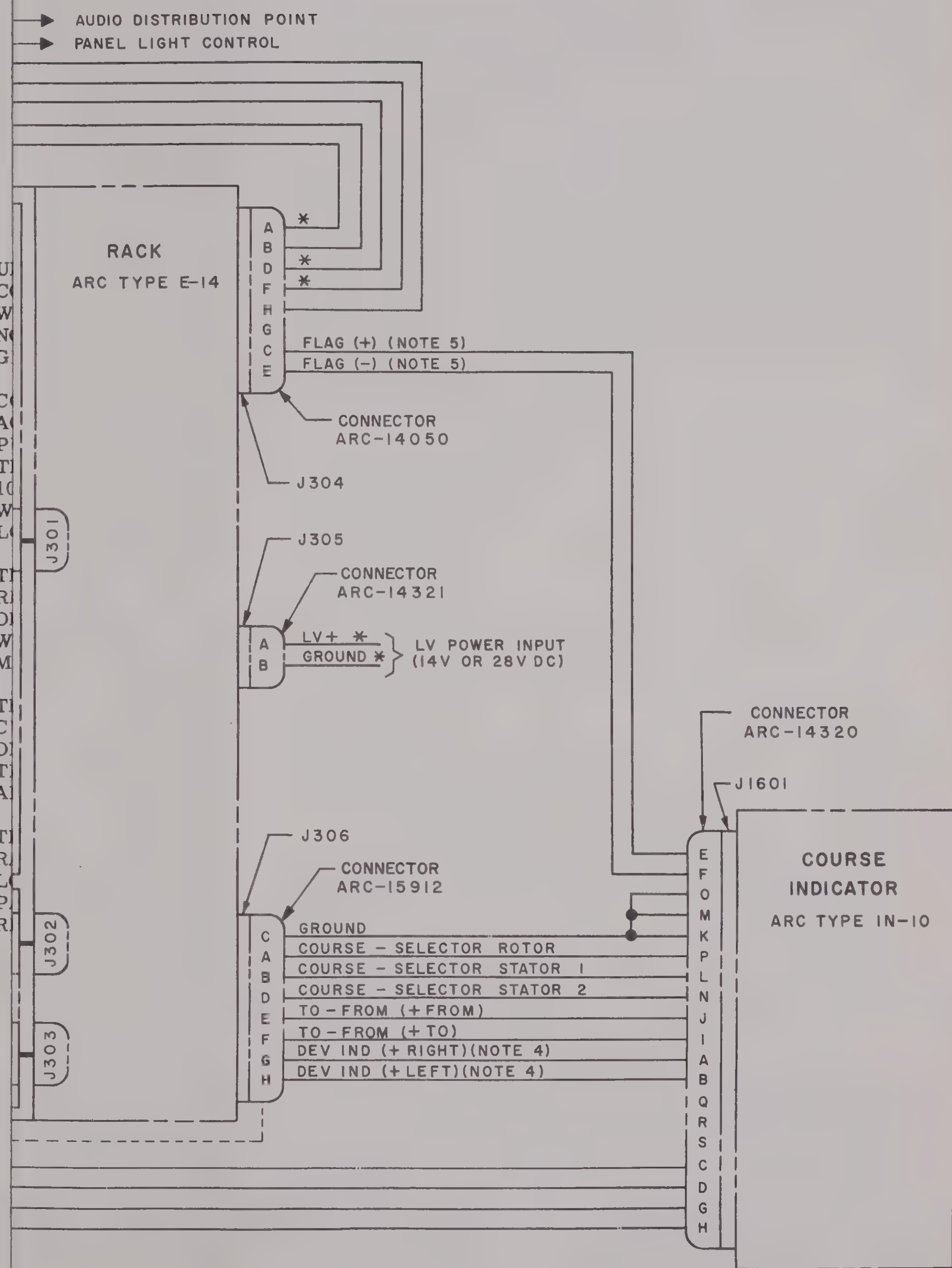


Figure 2–19. Type 15F and R-31A Glide Slope Receiver, Interconnection Diagram

NOTES:

1. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 16 STRANDED COPPER, FIBROUS-GLASS INSULATED.

2. CONNECT A 1000-μF DAMPING CAPACITOR ACROSS THE DEVIATION INDICATOR OUTPUT CIRCUIT OF THE R-31A RECEIVER. THIS CIRCUIT IS DESIGNED FOR THREE 1000-OHM LOADS IN PARALLEL. SHUNT WITH SUITABLE RESISTANCE IF FEWER LOADS ARE USED.

3. THE FLAG OUTPUT CIRCUIT OF THE R-31A RECEIVER IS DESIGNED FOR TWO 1000-OHM METER LOADS IN PARALLEL. SHUNT WITH A 1000-OHM RESISTOR IF ONLY ONE METER IS USED.

4. THE DEVIATION INDICATOR OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE APPROPRIATE RESISTOR FROM THE RACK.

5. THE FLAG OUTPUT CIRCUIT OF THE E-14 RACK IS DESIGNED FOR ONE 1000-OHM LOAD. FOR EACH ADDITIONAL LOAD IN PARALLEL, REMOVE APPROPRIATE RESISTOR FROM THE RACK.

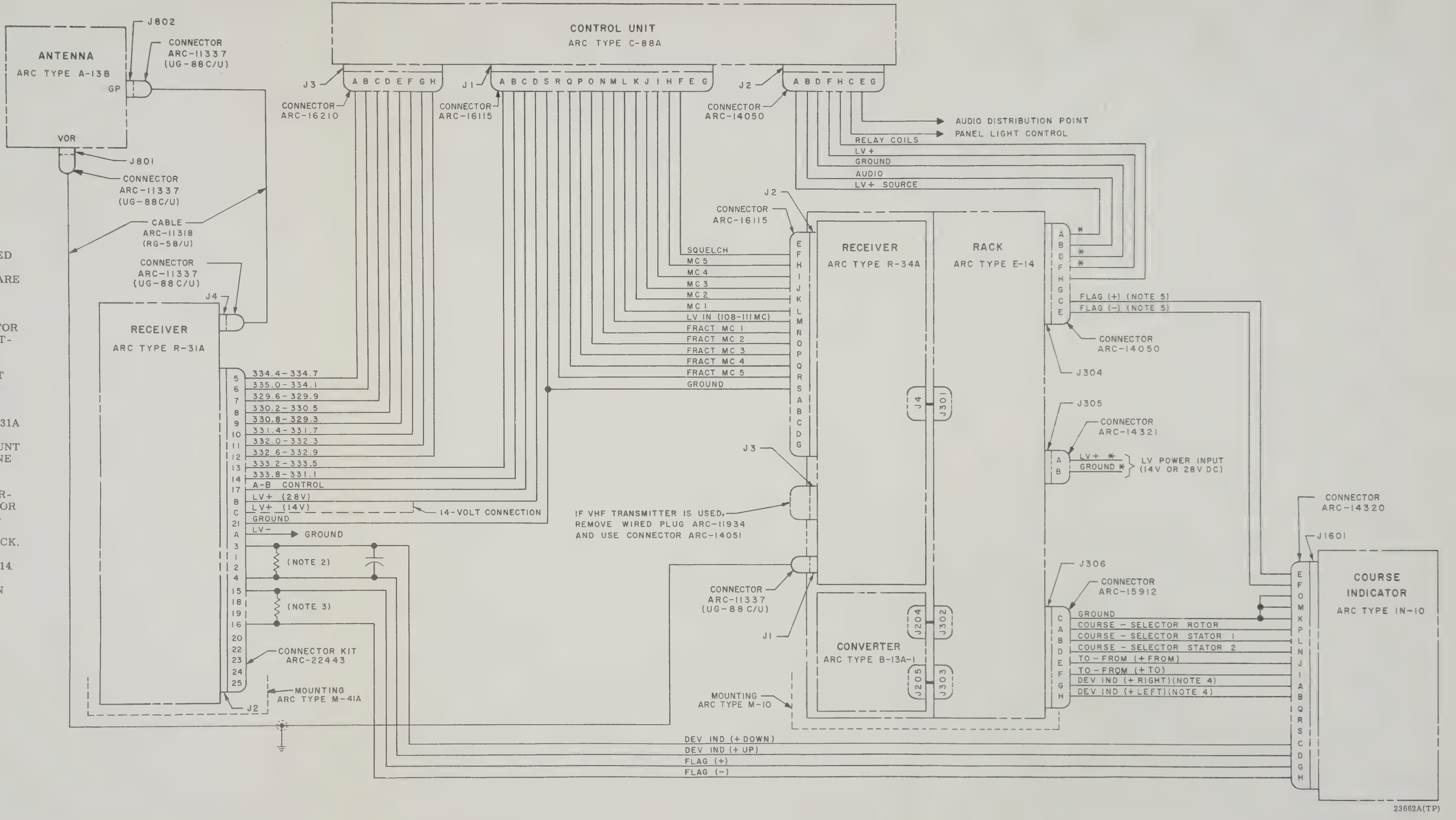


Figure 2–19. Type 15F and R-31A Glide Slope Receiver, Interconnection Diagram

2–7. INITIAL ADJUSTMENTS AND TESTS.

General. After installation, if local squelch is to be used, the R-34A Receiver squelch control, located on the front panel, should be adjusted and an operational test of the complete equipment should be made. If available, use an ARC Type H-14A Signal Generator as the signal source for the test.

Either a ramp test or a flight test may be used to check the complete equipment, although a ramp test is preferred. The use of an H-14A for ramp-testing is recommended because the use of actual VOR or localizer signals may lead to erroneous indications due to the effects of bending, reflection, etc. Also, the H-14A voice channel makes it possible for the operator to tell the Type 15F operator what test signals are being radiated.

Note

For all tests, take care to operate the H-14A in accordance with FCC regulations.

Squelch Control Circuits. The method used to control the squelch circuit may be selected as desired. Any one of the following control circuits may be used:

Local squelch. Connect pins E and F of J2 on the receiver front panel for local squelch control. The front panel SQUELCH control is adjusted after installation for a fixed squelch threshold level.

Local squelch and remote disable. Connect pins E and F of J2 on the receiver front panel and include an spst switch between pin F and pin S (ground) of J2. When pin F is grounded, the receiver squelch action is disabled; the presence of noise will indicate that the receiver is operating.

Remote squelch. For remote control of the squelch threshold level, a 100,000-ohm, linear-taper, variable resistor is connected between pins F and S of J2 on the receiver front panel. The resistor should be wired for maximum resistance in the muted position. This squelch circuit is used in the ARC Type C-81A and C-88A Control Units.

Local Squelch Adjustment. The SQUELCH control (R20) is located on the front panel of the R-34A. To set the squelch threshold level, adjust the control as follows:

Step 1. Loosen the SQUELCH control locknut and turn the control to the maximum counterclockwise position.

Step 2. Select a channel where no signal is received.

Step 3. With the aircraft engines and all electrical equipment operating normally, adjust the SQUELCH control clockwise until the receiver noise output is barely audible.

Caution

The setting of the squelch control affects the sensitivity of the receiver. Do not use the squelch control to remove excessive noise produced by external sources.

Step 4. Tighten the SQUELCH control locknut, being careful not to disturb the control setting.

Ramp Tests. The B-13A-1 Converter should be zero-balanced during the postinstallation ramp test to insure maximum accuracy of the IN-10 vertical pointer. Ramp-test the Type 15F as follows:

Step 1. Connect the ATTEN output of the H-14A Signal Generator through a Boonton Radio Type 505-B Attenuator to ANT connector J1 on the R-34A. Set the OMNI TRACK switch to 0°, MODULATION switch to OMNI, MC switch to position B (114.9 mc), and ATTENUATOR dial to 100 μv.

Step 2. Tune the receiver to 114.90 mc and set the IN-10 to 0°. The IN-10 vertical pointer should center, the flag should be out of sight, and the to-from meter should indicate TO. If necessary, adjust R225, located under the small cover at the rear of the converter, to center the pointer.

Step 3. Set the IN-10 to 180°. The vertical pointer flag should be out of sight, the vertical pointer should be centered, and the to-from meter should indicate FROM. If necessary, adjust R239, located under the small cover on the front of the converter, to center the pointer.

Step 4. As the H-14A operator announces the ANGLE-TO tracks for each 60° around the compass, adjust the course selector knob accordingly. The vertical pointer flag should be out of sight, the vertical pointer should be centered, and the to-from meter should indicate TO for each setting.

Note

If during the previous tests the vertical pointer, to-from meter, or vertical pointer flag exhibits signs of 30-cps vibration, the 1000-μf electrolytic capacitors in the E-14 or E-16 Rack require reforming. Refer to paragraph 5–3.

Step 5. Set the H-14A MC switch to position A (110.9 mc) and the MODULATION switch at AMP LOC ⏀ (pointer center).

Step 6. Tune the receiver to 110.9 mc. The vertical pointer should center. If necessary, adjust R264, located under the small cover on the front panel of the converter, to center the pointer.

Step 7. During the test signal transmission, check the operation of the volume control and the quality and available level of the voice transmission.

Step 8. Set the volume control on the C-81A fully clockwise. Strike the top and side of the R-34A and B-13A-1 sharply with the palm of the hand. There should be negligible microphonic noise and no signal interruption resulting from the blows.

Step 9. Turn all equipment off.

Flight Tests.

Note

If an H-14A Signal Generator, or equivalent, is not available, an in-flight equipment performance check may be made. Due to the difficulty of direct positioning while in flight, the allowable error tolerances of VOR stations, and other factors, a flight test is subject to error and should not be relied upon completely as an accurate check of the Type 15F installation.

A flight test of the Type 15F for VOR reception should include flying a straight track toward and over a VOR station from a point 75 miles out at approximately 6000 feet above the terrain. The flight test will check the sensitivity, course indication steadiness, and operation of the to-from meter. The course sensitivity may be checked during the flight by noting the number of degrees of shift on the IN-10 required for a full swing of the vertical pointer from the last dot on the left to the last dot on the right; the shift should be between 18° and 23°. Note the bearing for several known locations. Check these against the airways chart, remembering that the IN-10 reads magnetic bearing. Note the movement of the to-from meter while approaching and passing over a station. It should read TO while approaching the station and FROM when the station has been passed. In a limited region above the station (the "cone of confusion"), the readings of both the vertical pointer and the to-from meter will be erratic. Note that when flying on course toward the station with the to-from meter showing TO, a movement of the vertical pointer to the right or left requires flying to the right or left, respectively, to get back on course. This same rule follows in flying on course away from the station with the to-from meter showing FROM.

A flight check of a 90/150-cps runway localizer should be made for accuracy and range, and to make certain that a movement of the vertical pointer to the left or right requires steering left or right, respectively, to get back on course. An on-course indication should lead the airplane directly down the centerline of the runway. The course is necessarily very "tight" on a localizer approach, in order to insure positional accuracy.

Instability of VOR Presentation. If during either of the postinstallation tests described in the preceding paragraphs the vertical pointer exhibits instability during VOR reception, it is possible that the use of unshielded wiring to the IN-10 course selector section may be allowing transient voltages to be induced into the wiring between the IN-10 and the rest of the equipment. Transient voltages may also appear if the course selector leads are bundled with power leads, or with leads that may be conducting noise from one part of the airplane to another. To remedy this condition, shield the IN-10 course selector leads and ground the shielding.

SECTION III
OPERATION

3–1. OPERATING LIMITATIONS AND PRECAUTIONS.

General. The Type 15F is subject to operating limitations imposed by the characteristics of vhf transmission. These limitations, described in the following paragraphs, are usually transitory in nature.

Reception of Reflected Radio Waves. Vhf radio waves are reflected when they strike an object of different conductivity and dielectric constant than the atmosphere through which they are moving. When reflection occurs, the combined effect of the direct and reflected wave produces a pattern of alternate lobes of reinforced and cancelled waves in the area above the reflecting surface. Radio reception may be subject to fading as the aircraft passes through this area. When fading occurs, the vertical pointer may fluctuate considerably and the flag may show intermittently.

Shadow Effect. Large obstacles, usually natural rather than man-made, will produce a shadow area on the side away from the transmitting antenna in which reception will be very poor or nonexistent. This effect may be overcome by increasing altitude.

Duct Effect. Trapping of vhf radio waves in atmospheric ducts will frequently extend the range of transmitted waves several times over their normal usable range. This effect may cause a station normally out of range to interfere with the reception of a desired in-range station. Although ducts may extend for miles, a pilot can usually fly out of them since they are frequently shallow.

Usable Transmission Distances. In vhf transmission the radiated waves generally travel in an approximately straight line. Therefore, the maximum usable transmission distance will depend on the location of the transmitting and receiving antennas. Table 3–1 gives the approximate line-of-sight transmission range for various receiving antenna heights.

Operating Precautions. The following precautions should be considered when using the Type 15F equipment:

1. The IN-10 indicates the position of the aircraft with respect to a selected course. It does not indicate the magnetic heading of the aircraft.

2. During VOR operation, maintain the desired general heading. Do not make excessive heading changes to keep the pointer centered. Fly the general trend of the pointer to prevent overcorrecting.

3. When making a back-course localizer approach, or when flying out on a localizer approach course, fly away from the pointer to return to the center (on course) of the localizer beam.

4. Make relatively small changes in heading during a localizer approach. Small deviations (2.5°) from the center of the localizer beam will produce a full-scale deflection of the course indicator vertical pointer.

5. Do not use the equipment for navigational purposes if the IN-10 flag is visible or in the absence of a TO-FROM indication.

TABLE 3–1. LINE-OF-SIGHT DISTANCES FOR VHF TRANSMISSION

Aircraft Altitude (Ft)	*Approximate Transmission Range (Nautical Miles)*	*Aircraft Altitude (Ft)*	*Approximate Transmission Range (Nautical Miles)*
100	12	4000	70
200	15	5000	80
400	25	8500	100
600	30	10,000	115
800	35	12,500	125
1000	40	15,000	135
2000	50	17,500	145
3000	65	20,000	160

3–2. OPERATING CONTROLS.

All controls required for operating the Type 15F are located on the control unit and course indicator (see Figures 3–1 and 3–2). The control functions of the C-81A and C-88A are identical, except that the C-88A also selects, automatically and simultaneously, the correct glide slope frequency for the selected localizer frequency. Except for the volume and squelch controls, which are installed separately, the CC-11A and CC-12A Custom Control Units duplicate the functions of the C-81A and C-88A, respectively. Table 3–2 lists the control unit operating controls and their functions.

The course selector knob on the IN-10 and IN-14 is used to determine the magnetic bearing of the aircraft relative to the VOR station being received and to select a desired course to or from the station.

Figure 3–1. C-81A and C-88A Control Units, Operating Controls

Figure 3–2. IN-10 and IN-14 Course Indicators, Operating Controls

TABLE 3–2. OPERATING CONTROLS

Control Designation	*Function*
VOL-OFF	Combination volume control and on-off switch. Controls application of power to the Type 15F. Clockwise rotation turns power on. Further clockwise rotation increases audio level of R-34A.
SQUELCH	Controls receiver squelch circuit. Clockwise rotation silences the receiver.
Megacycle Channel Selector Switch (no panel marking)	Selects megacycle channel frequency, in 1-mc steps, between 108 and 126 mc.
Fractional Megacycle Channel Selector Switch (no panel marking)	Selects fractional megacycle channel frequency, in 0.1-mc steps, between 0.0 and 0.9 mc.

3–3. OPERATING PROCEDURES.

Use of Omnidirectional Range (VOR). A vhf omnidirectional range (VOR) offers an infinite number of courses to or from the station. In comparison with other available navigational facilities, where both sight and sound are necessary for maintaining a course, VOR navigation depends principally upon the visual indications supplied by a vertical pointer. VOR may be likened to the standard low-frequency range, if there were but one leg whose

bearing was under the control of the pilot, and if the on-course indication were given visually by the vertical pointer of the deviation indicator. In the VOR system, the pilot sets up any course he desires using his course selector, and then flies that course by reference to the vertical pointer.

The following navigation procedures are typical of those that may be flown using VOR facilities:

1. Determination of aircraft bearing relative to a VOR station
2. Flying a desired course to or from a VOR station
3. Flying to an objective using two VOR stations
4. Approximate ground-speed check using two VOR stations
5. Intersecting a localizer using a VOR station
6. Approach procedure

Figure 3–3 illustrates and notes the basic operating principles of flying a VOR range. In this illustration, the to-from meter and vertical pointer indications are shown for several aircraft locations with respect to a selected VOR station and a course indicator setting of 90°.

Determination of Aircraft Bearing Relative to VOR Station. To determine the bearing of an aircraft relative to a VOR station, proceed as follows:

Step 1. Turn the OFF-VOL switch on. Allow the equipment to warm up.

Step 2. Tune in the desired VOR station and identify. Make certain that the IN-10 vertical pointer flag is out of sight.

Step 3. Rotate the IN-10 course selector knob until the vertical pointer is centered.

Step 4. Read the IN-10 bearing, which is the magnetic bearing of the aircraft relative to the VOR station, and note whether it is TO or FROM the station as indicated by the to-from meter.

Step 5. The general location of the aircraft with respect to the VOR station may be determined as follows: If, for example, the bearing is 90° TO, the aircraft is west of the station; if the bearing is 90° FROM, the aircraft is east of the station.

Note

VOR supplies only position information. The IN-10 does not indicate the heading of the aircraft. See Figure 3–3.

Step 6. To determine the actual position of the aircraft, tune in a second VOR station and plot its bearing against the bearing of the first VOR station.

Flying a Desired Course To or From a VOR Station. To fly a desired course to or from a VOR station, proceed as follows:

Step 1. Turn the OFF-VOL switch on. Allow the equipment to warm up.

Step 2. Tune in the desired VOR station and identify. Make certain the IN-10 vertical pointer flag is out of sight.

Step 3. Rotate the course selector knob so that the IN-10 pointer points to the desired course to or from the station. Check that the to-from meter indicates TO or FROM, depending on the desired direction of flight.

Step 4. Note the position of the vertical pointer and the to-from meter. If the course chosen is to the VOR station and the aircraft is less than about 70° from the selected course, the to-from meter will indicate TO. If the course chosen is from the station and the aircraft is less than about 70° from the selected course, the to-from meter will indicate FROM. If the aircraft is in the vicinity of 90° from the selected course, the to-from meter will be neutral (no indication will be visible), and the pilot will have to visualize his position with respect to the desired course.

Step 5. If a definite TO-FROM indication is obtained, turn the aircraft until its magnetic heading is the same as the bearing shown on the IN-10. Observe the position of the vertical pointer. To position the aircraft on the desired course, "fly toward the pointer"; that is, if the pointer is left of center, fly a heading somewhat to the left and hold the chosen heading until just prior to reaching the desired course; if it is right of center, fly a heading somewhat to the right until just prior to reaching the desired course. Begin to reduce the intercept angle as the desired course is approached to prevent overshooting the course. The initial intercept angle will depend on the displacement from the desired course. If far off course (pointer hard over), an initial intercept angle up to 90° may be chosen. If only one or two dots off course, intercept angles of only 5° to 10° are required. When the pointer is centered, the aircraft is on the selected course. Attempt to keep the pointer directly in the center. If the vertical pointer fluctuates, fly the general trend of the pointer to prevent overcorrection. If the compass heading and the IN-10 bearing are about 180° apart, it indicates that the aircraft is heading in a direction opposite to the desired course. An attempt to "fly toward the pointer" under this condition will cause the pointer to move still further left or right. To correct the situation, make a 180° turn and then "fly toward the pointer."

Note

VOR supplies only position information. Direction or heading information must still be obtained from the compass. The rule of "steer toward the pointer" is applicable only if the course indicator bearing and the compass heading are kept in general agreement and in agreement with the course it is desired to make good.

Flying to an Objective Using Two VOR Stations. The procedure for flying to an objective using two VOR stations is outlined and illustrated in Figures 3–4 and 3–5.

Ground-speed Check Using Two VOR Stations. An approximate ground-speed check can be made using two VOR stations. The procedure is outlined and illustrated in Figure 3–6.

Intersection of Localizer Using a VOR Station. The procedure for intersecting a localizer path using a VOR station is outlined in Figure 3–7.

Procedure for VOR Approaches. Approaches, using VOR, may be made where authorized, in accordance with published information. The required procedures are the same as for flying a desired course to or from a VOR station.

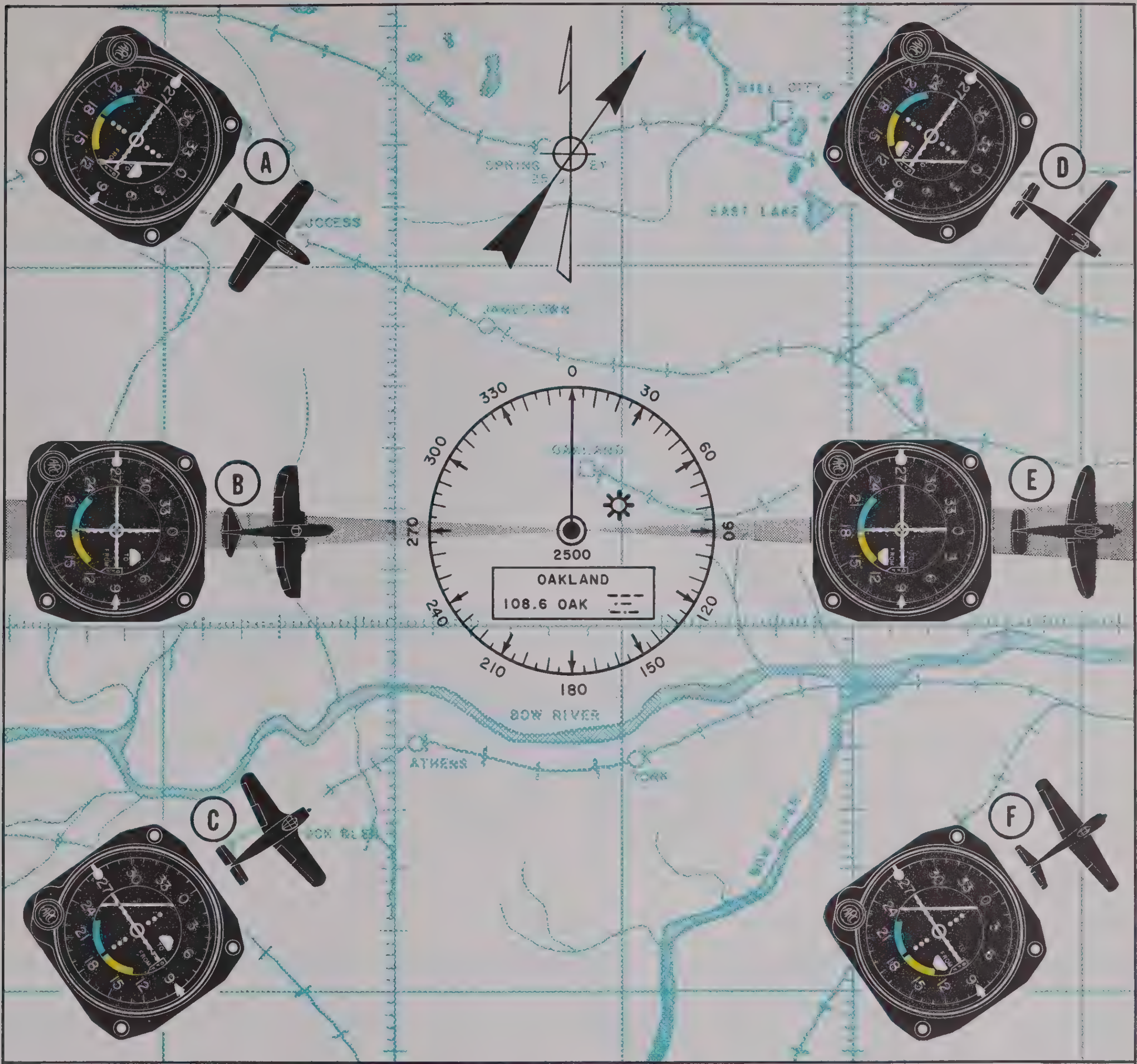
Indications of Arrival Over VOR Station. Upon arrival over a VOR station, the aural signal and the indications on the IN-10 are affected as follows:

1. The aural signal suddenly increases in strength and may become distorted.
2. The vertical pointer on the IN-10 swings abruptly from side to side.
3. The vertical pointer flag appears and disappears in rapid succession.
4. The to-from meter of the IN-10 becomes erratic, fluctuating between TO and FROM, and finally steadies into the FROM position, indicating that the aircraft has passed the VOR station.

Use of Localizers. For localizers, transmission of two modulations produces a sharp course that provides a pilot with lateral guidance during an approach. A proper front-course approach will result in a center-reading of the IN-10 vertical pointer. If the pointer is to the right of center, the aircraft must move to the right to get on course, and if the pointer is to the left of center, the aircraft must move to the left to get on course. If, however, a back-course approach is followed, the procedure for centering the pointer is reversed.

Localizer Approaches. The procedure for a front-course approach using localizers is outlined and illustrated in Figure 3–8. If the approach to the airport follows a localizer back course, follow the procedure described in Figure 3–9.

Vhf Communication System. In addition to its navigational uses, the Type 15F can operate as part of a vhf communication system when used with an appropriate ARC transmitter. Figure 2–18 shows a typical installation of the Type 15F with a T-25A Transmitter.



NOTES:

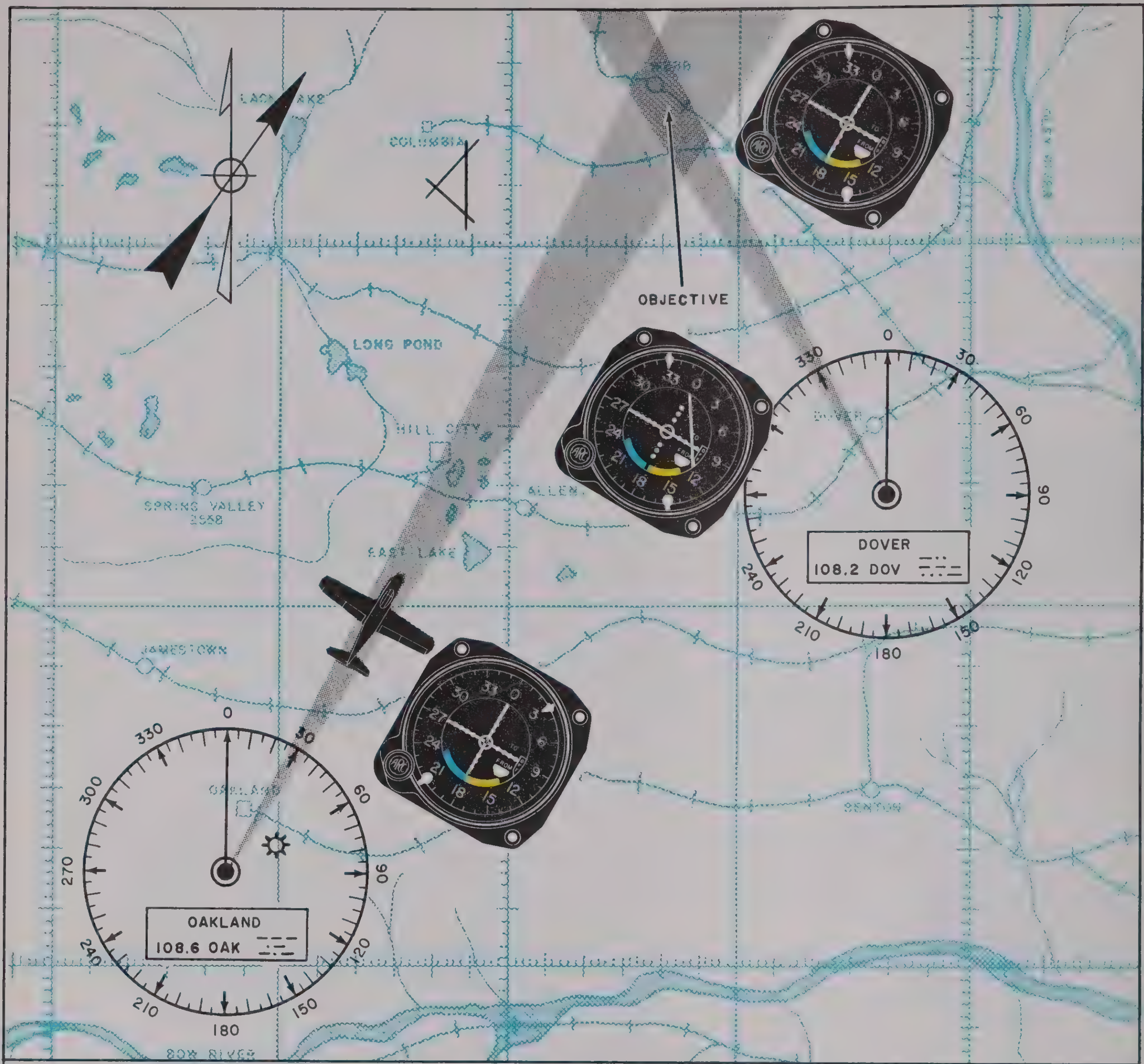
1. The pilot of each aircraft has selected a 90° course to or from Oakland VOR. All aircraft are on course or within 70° of course. Since aircraft A, B, and C are west of station, their IN-10 to-from meters indicate TO; since aircraft D, E, and F are east of station, their to-from meters indicate FROM.

2. Aircraft B and E are on course as indicated by centered IN-10 vertical pointer.

3. Aircraft A and D are north of course and aircraft C and F are south of course. The vertical pointer in each of these aircraft indicates the general position of aircraft with respect to selected course. This positional information plus heading information supplied by the DG (directional gyro) enables a pilot to determine direction of flight required to intercept a selected course.

TP1789

Figure 3–3. Instrument Indications During VOR Flight



PROCEDURE:

1. Determine magnetic bearing of objective from Oakland VOR and from Dover VOR. For example, assume objective lies 30° from Oakland and 330° from Dover, and aircraft is positioned as shown.

2. Operate Type 15F as outlined in paragraph 3-3 to fly a 30° course FROM Oakland. Check vertical pointer frequently to stay on course.

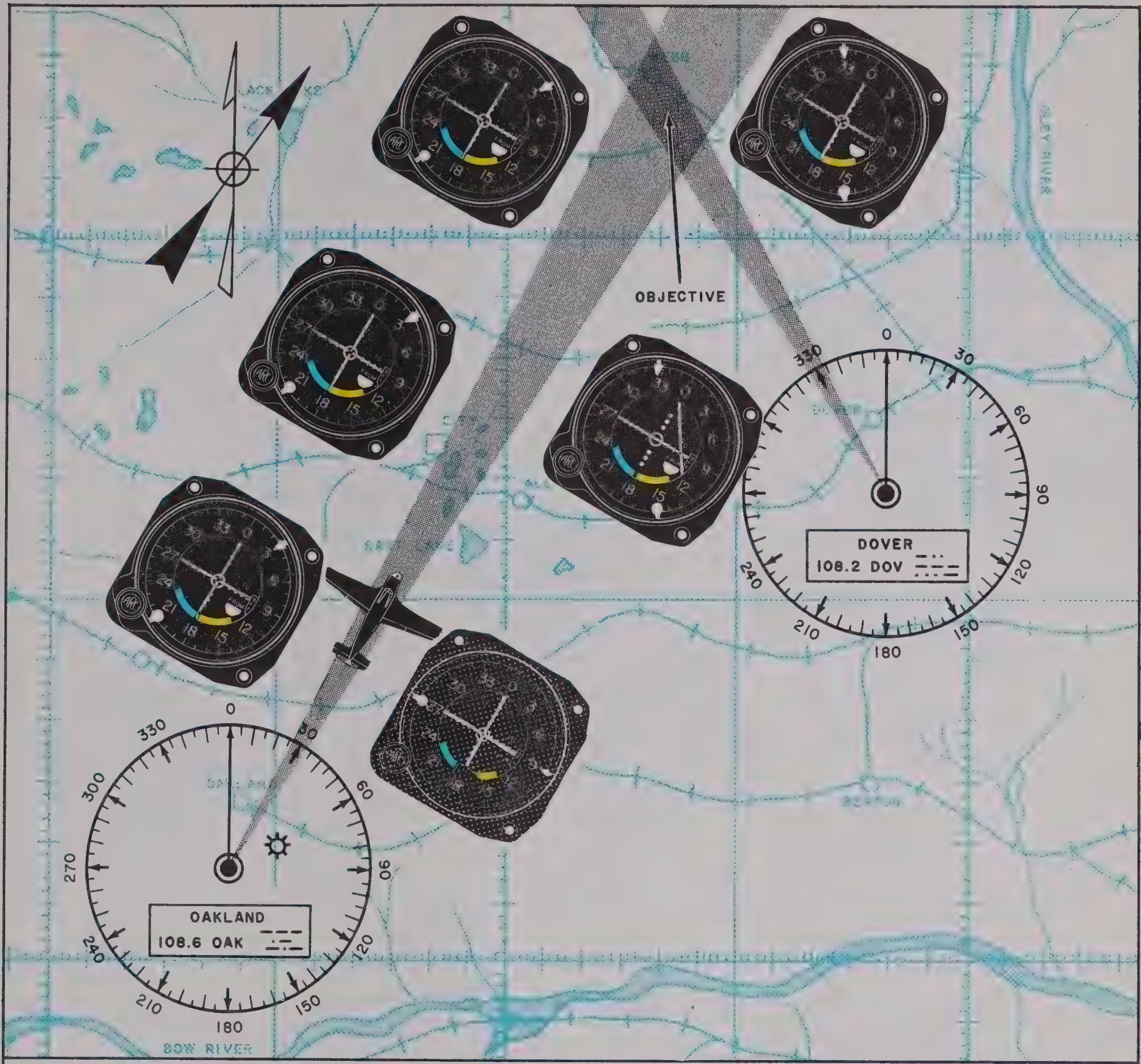
3. Before the 330° Dover bearing is reached, tune in Dover VOR and set IN-10 to 330°. Use DG (directional gyro) to maintain 30° course FROM Oakland. When vertical pointer centers, aircraft is over objective.

Note

The time at which Dover VOR is tuned in depends on distances between objective and VOR stations. Remain tuned to Oakland VOR as long as possible.

TP1791

Figure 3–4. Flying to an Objective Using Two VOR Stations and One Type 15F Equipment



PROCEDURE:

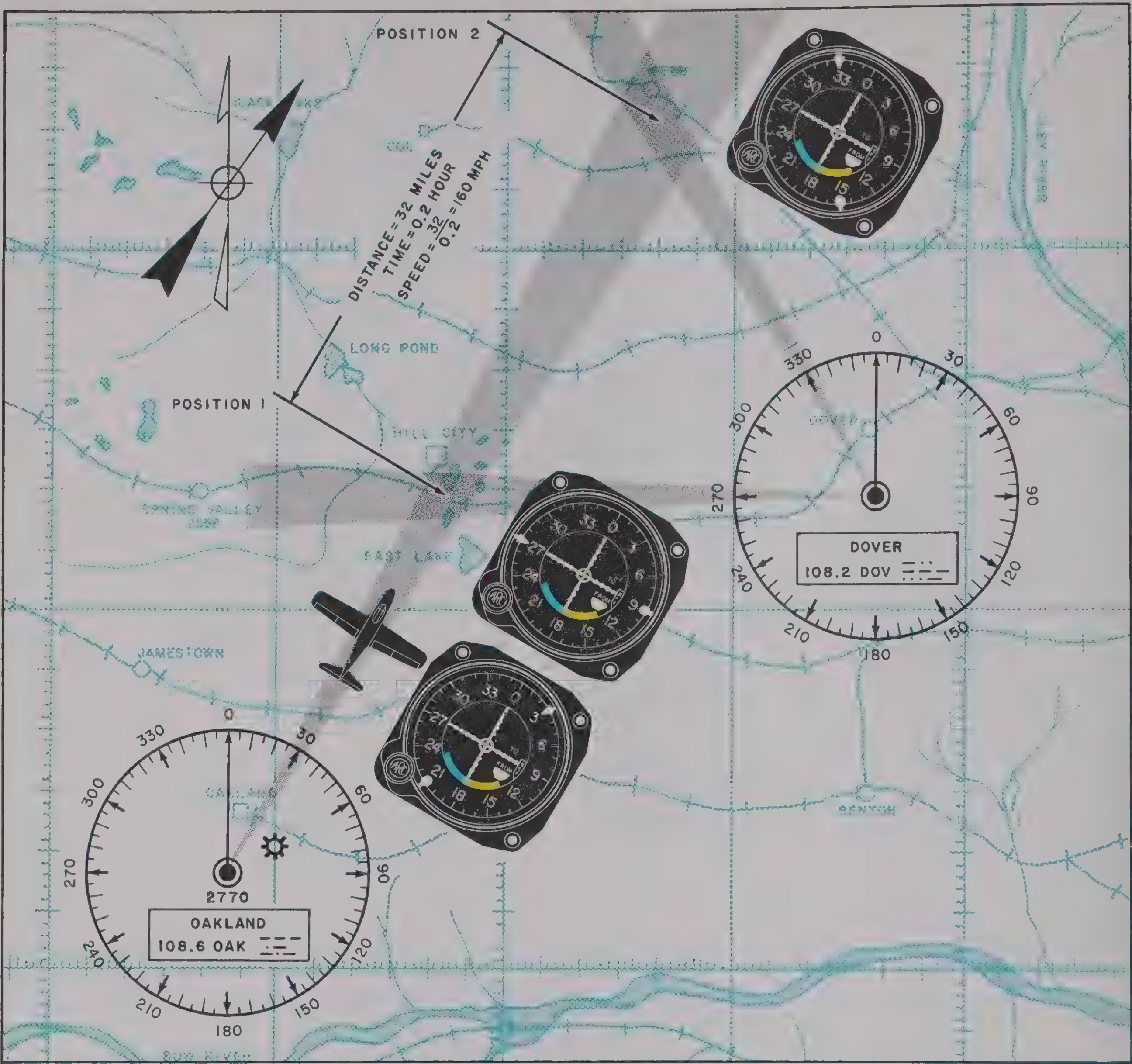
1. Determine magnetic bearing of objective from Oakland VOR and from Dover VOR. For example, assume objective lies 30° magnetic from Oakland and 330° magnetic from Dover, and that aircraft is positioned as shown.

2. Operate one Type 15F as outlined in paragraph 3-3 to fly a 30° course FROM Oakland. Make necessary allowances for drift. Check vertical pointer frequently to stay on course.

3. Tune second Type 15F to Dover VOR, and set associated IN-10 course selector to 330°. Maintain 30° course FROM Oakland, and note when vertical pointer on IN-10 set to Dover bearing centers. Aircraft is over objective when both vertical pointers center.

TP1793

Figure 3–5. Flying to an Objective Using Two VOR Stations and Two Type 15F Equipments



PROCEDURE:

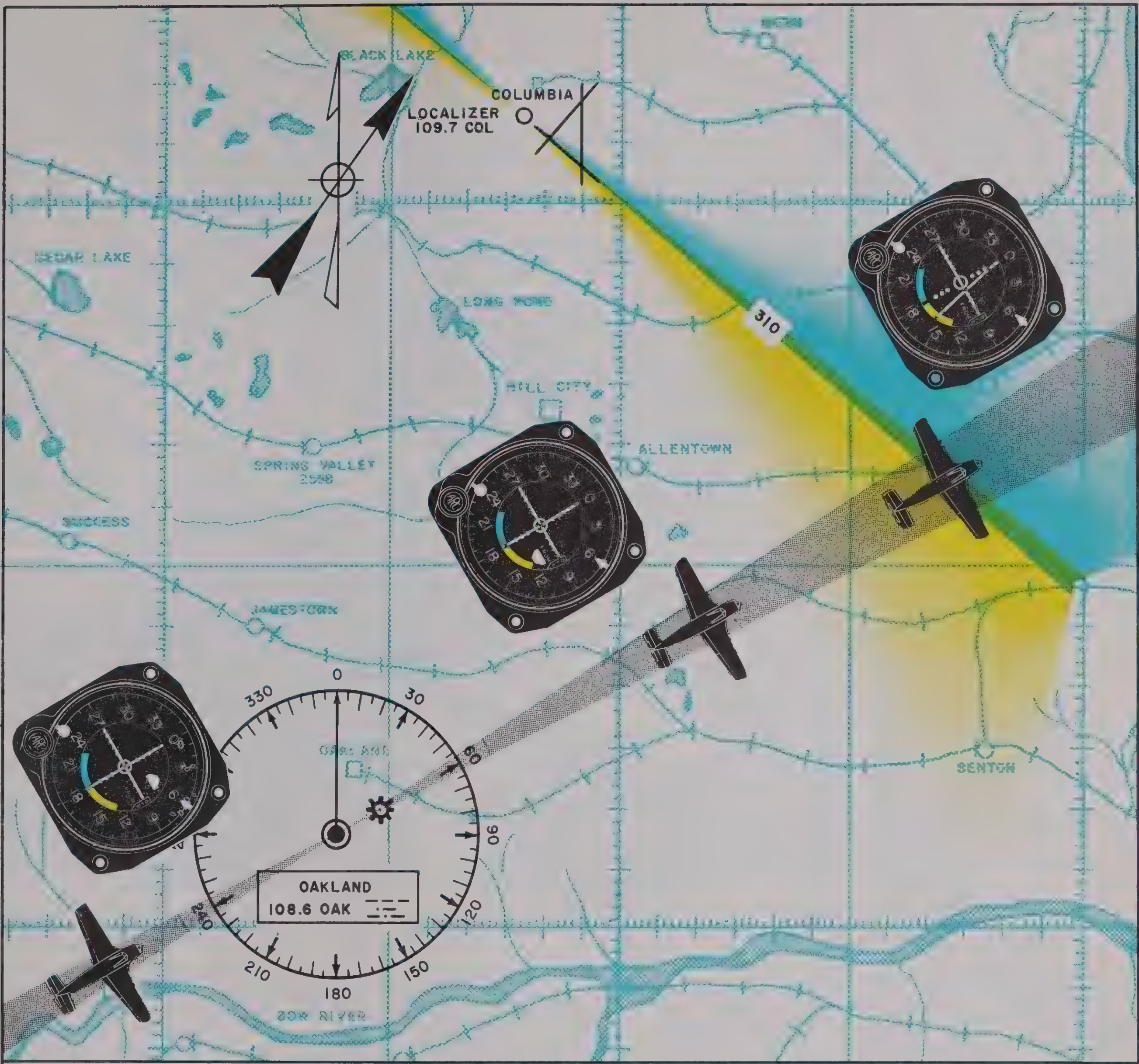
1. Chart a desired course of, for example, 30° FROM Oakland VOR. Set and fly course as outlined in paragraph 3-3. IN-10 course selector should be set at 3, to-from meter should read FROM, and vertical pointer should be centered. The aircraft heading, indicated on DG, may differ from 30° due to crosswind. If heading is adjusted to keep pointer centered, track will be 30° FROM.
2. Tune to Dover VOR and note its bearing with respect to aircraft. In the example, it is 270° FROM (position 1).
3. Continue to fly Oakland 30° FROM course.
4. After a selected time period has elapsed (0.2 hour for example), take a second bearing on Dover VOR. Plot bearing.
5. Measure distance (D) between positions 1 and 2.
6. Calculate speed, which is $\frac{D}{T} = \frac{32 \text{ miles}}{0.2 \text{ hour}} = 160$ mph.

Note

If two Type 15F Equipments are used, tune one to Oakland VOR and the other to Dover VOR. The method of checking ground speed is the same as outlined above except that it is not necessary to switch from station to station.

TP1795

Figure 3–6. Approximate Ground-speed Check Using Two VOR Stations



PROCEDURE:

1. In the example, it is assumed that desired point of intersection of Columbia localizer lies 60° magnetic from Oakland VOR and that aircraft is southwest of Oakland.

2. Set and fly desired course of 60° TO Oakland. Continue to fly 60° course, pass over the station, and fly a course 60° FROM Oakland.

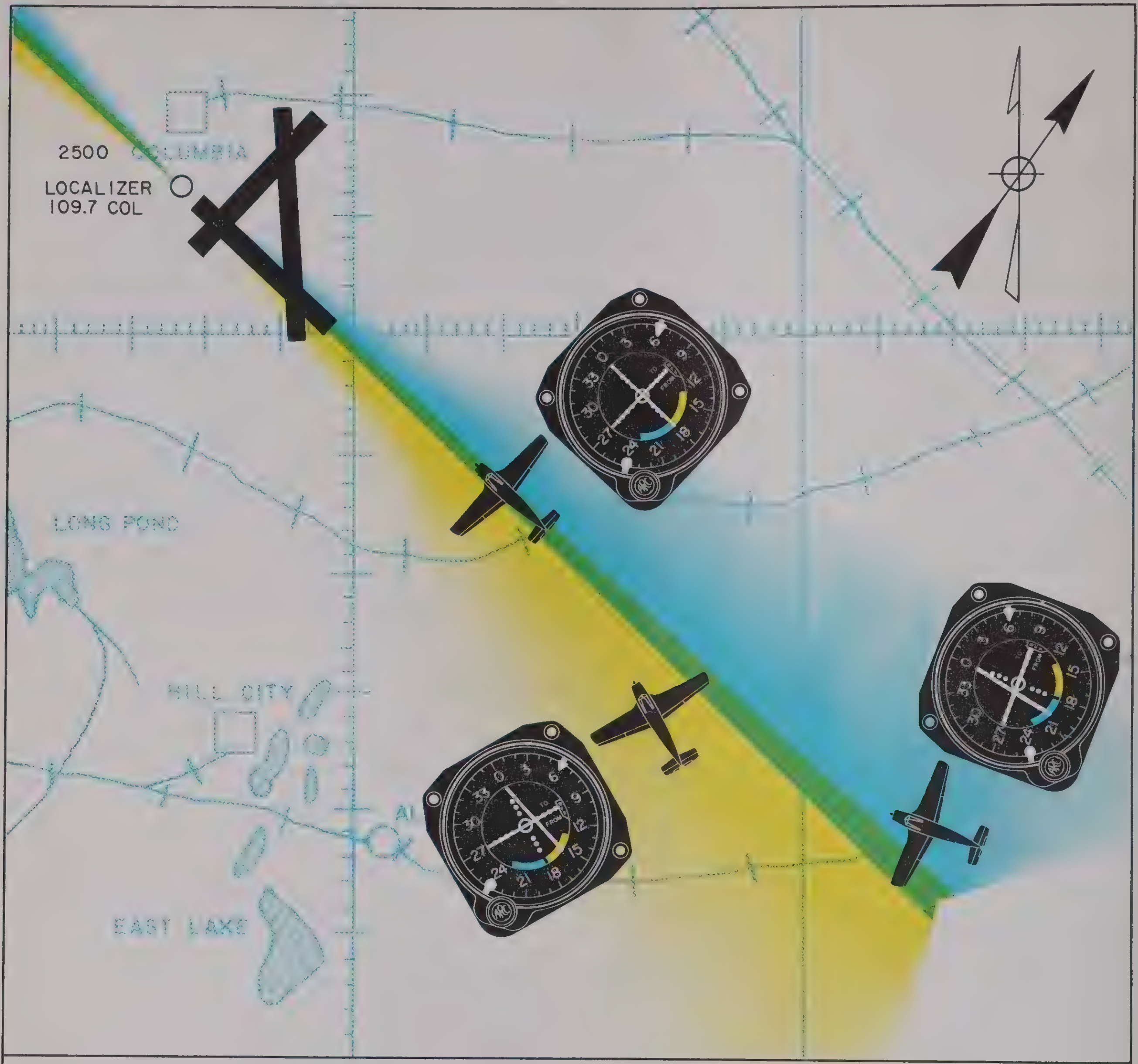
3. As localizer beam is approached, tune to Columbia localizer frequency and identify station. IN-10 vertical pointer will indicate aircraft is in yellow sector of beam when localizer is first tuned in. As 60° course FROM Oakland is continued, vertical pointer will move left. When centerline of localizer course is reached, vertical pointer will center.

Note

If two Type 15F Equipments are used, tune one to Oakland VOR and the other to Columbia localizer. Keep vertical pointer of IN-10 used for VOR indications centered, and intersect localizer beam when vertical pointer of IN-10 used for localizer indications centers.

TP1797

Figure 3–7. Intersection of Localizer Course Using VOR Station



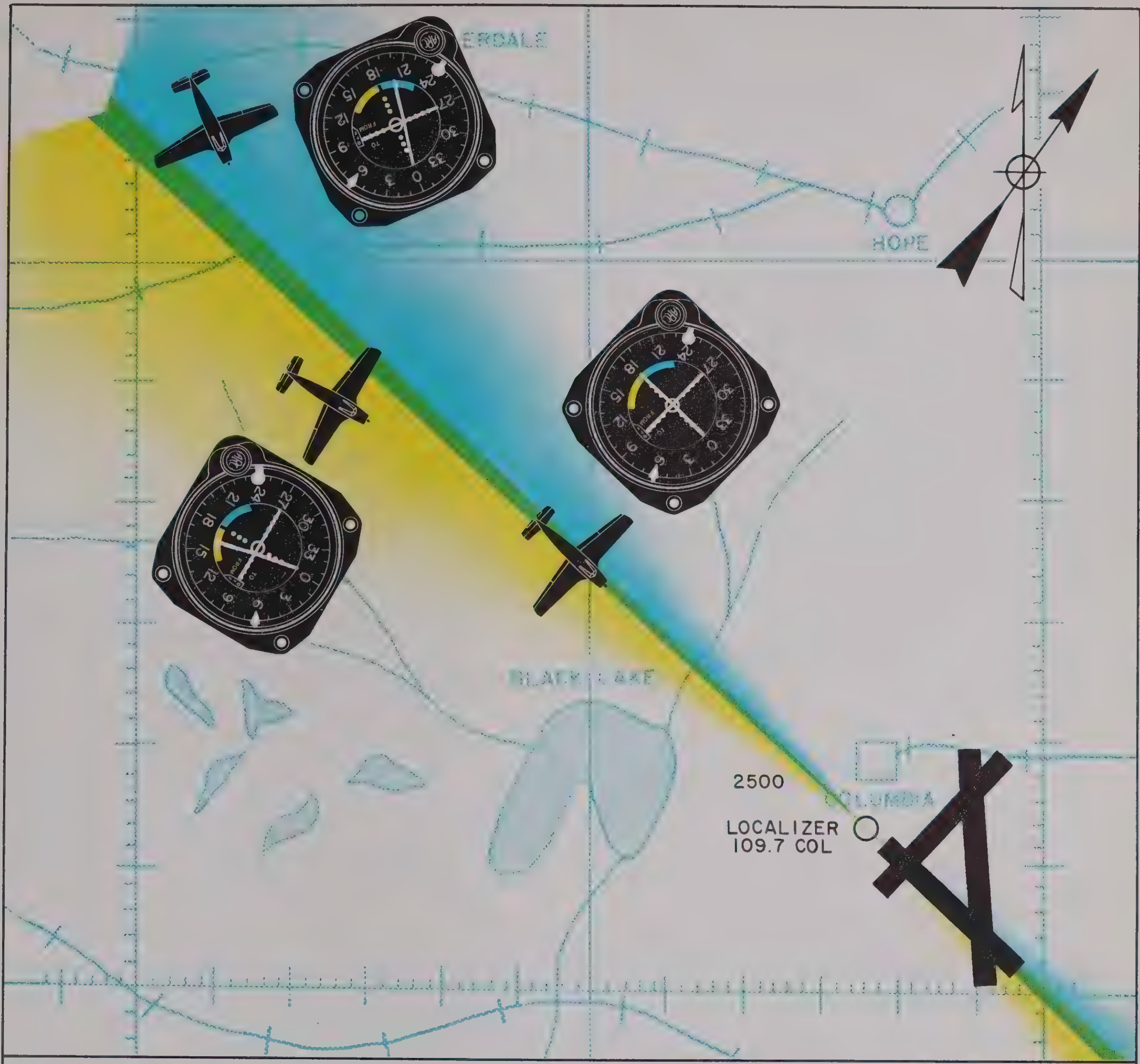
PROCEDURE:

1. Tune in Columbia localizer and identify. Make certain IN-10 vertical pointer flag is out of sight.

2. After necessary preliminary flight procedures, which should be in accordance with published information for approach concerned, check position of vertical pointer and begin approach. If pointer is left of center, fly left; if right of center, fly right. When aircraft is properly positioned (laterally) with respect to runway centerline, vertical pointer will center.

TP1799

Figure 3–8. Instrument Indications, Localizer Front-course Approach



PROCEDURE:

1. Tune in Columbia localizer and identify. Make certain IN-10 vertical pointer flag is out of sight.

2. After necessary preliminary flight procedures, which should be in accordance with published information for approach concerned, check position of vertical pointer and begin back-course approach. If pointer is left of center, fly right; if right of center, fly left. When aircraft is properly positioned (laterally) with respect to runway centerline, vertical pointer will center.

Note

Note that during a back-course approach, vertical pointer movements are opposite to those obtained during a front-course approach (see Figure 3-8).

TP1801

Figure 3–9. Instrument Indications, Localizer Back-course Approach

NOTES

SECTION IV
PRINCIPLES OF OPERATION

4–1. INTRODUCTION.

General. This section describes the principles of operation of the ARC Type 15F VHF Navigation Equipment and its individual units. An over-all functional description of the complete equipment is followed by detailed descriptions of each unit's circuits. Schematic and functional diagrams are included to supplement the circuit descriptions.

Use of Type 15F Equipment. The Type 15F receives, interprets, and indicates aircraft navigational data. It may also be used as the receiving end of a vhf communication system. The types of navigation transmissions that can be received are VOR (vhf omnidirectional range) and localizers.

VOR Reception. A VOR station radiates an infinite number of courses around its antenna system. The courses are called radials since they radiate from the five-element antenna system like spokes from the hub of a wheel (see Figure 4–1). The radials are formed by transmitting a signal that consists of two independent components: the reference phase signal and the variable phase signal. The reference phase signal produces an omnidirectional field pattern around the antenna system, the phase of which does not vary with direction. The variable phase signal produces a rotating figure-eight field pattern by using a goniometer rotated at a 30-rps rate to feed each pair of the four antenna elements alternately (see Figure 4–1). The phase of the variable signal, with respect to the reference signal, changes constantly at a 30-cps rate. The phase realtionship between the reference and variable signals, therefore, is a function of the bearing of the receiving equipment from the VOR transmitter's magnetic north radial. The phase relationship between the two signals is zero (signals in phase with each other) at all points on the magnetic north radial. On all other radials, they differ in phase according to the degree of angular displacement from magnetic north. When operating on VOR, the Type 15F receives and amplifies the two signal components, detects the phase difference, and indicates the bearing from the transmitter on the IN-10 Course Indicator.

Runway Localizer Reception. Runway localizers use 90- and 150-cps modulation signals (see Figure 4–2). On the runway centerline these two modulations are equal in strength. On either side of the centerline one modulation signal is stronger than the other. When tuned to a runway localizer, the Type 15F rectifies and compares the 90- and 150-cps signals and feeds a d-c current proportional to the difference in amplitude of these signals to the IN-10. If the pilot is making his approach properly, the two equal signals center the indicator reading. If the aircraft is off course during a front-course approach, however, the stronger signal will cause the indicator to read off center by an amount determined by the displacement of the aircraft from the desired course. For example, if the pointer deflects to the right, the aircraft is to the left of the proper path and a correction to the right must be made.

4–2. FUNCTIONAL DESCRIPTION.

Power Distribution. Operating voltage for power relay K301 is applied through the E-14 Rack to the C-81A Control Unit (see Figure 4–3). With the closing of the power switch on the control unit, relay K301 in the rack is energized, completing the filament circuits of the R-34A Receiver and B-13A-1 Converter, and applying operating voltage through the R-34A to the Dynaverter. The high voltage developed by the Dynaverter is distributed to the receiver and through the E-14 Rack to the converter. Power for the panel lamps of the control unit is supplied through a separate lead connected to the primary power source.

Signal Distribution. With the R-34A tuned by the control unit to an incoming signal, the signal picked up by the antenna is fed through coaxial cable to the input circuits of the R-34A. The r-f signal passes through, and is modified by, the r-f, i-f, and detector stages of the receiver. The output of the detector stage consists of a navigation signal or communication signal, or both. The navigation signals are routed through a cathode follower, used for impedance matching and isolation of the detector stage, to the B-13A-1 Converter. The communication signals are applied to the receiver audio output stages where squelch control is introduced and further amplification of the signal takes place. The audio output of the receiver is fed to the audio distribution circuits.

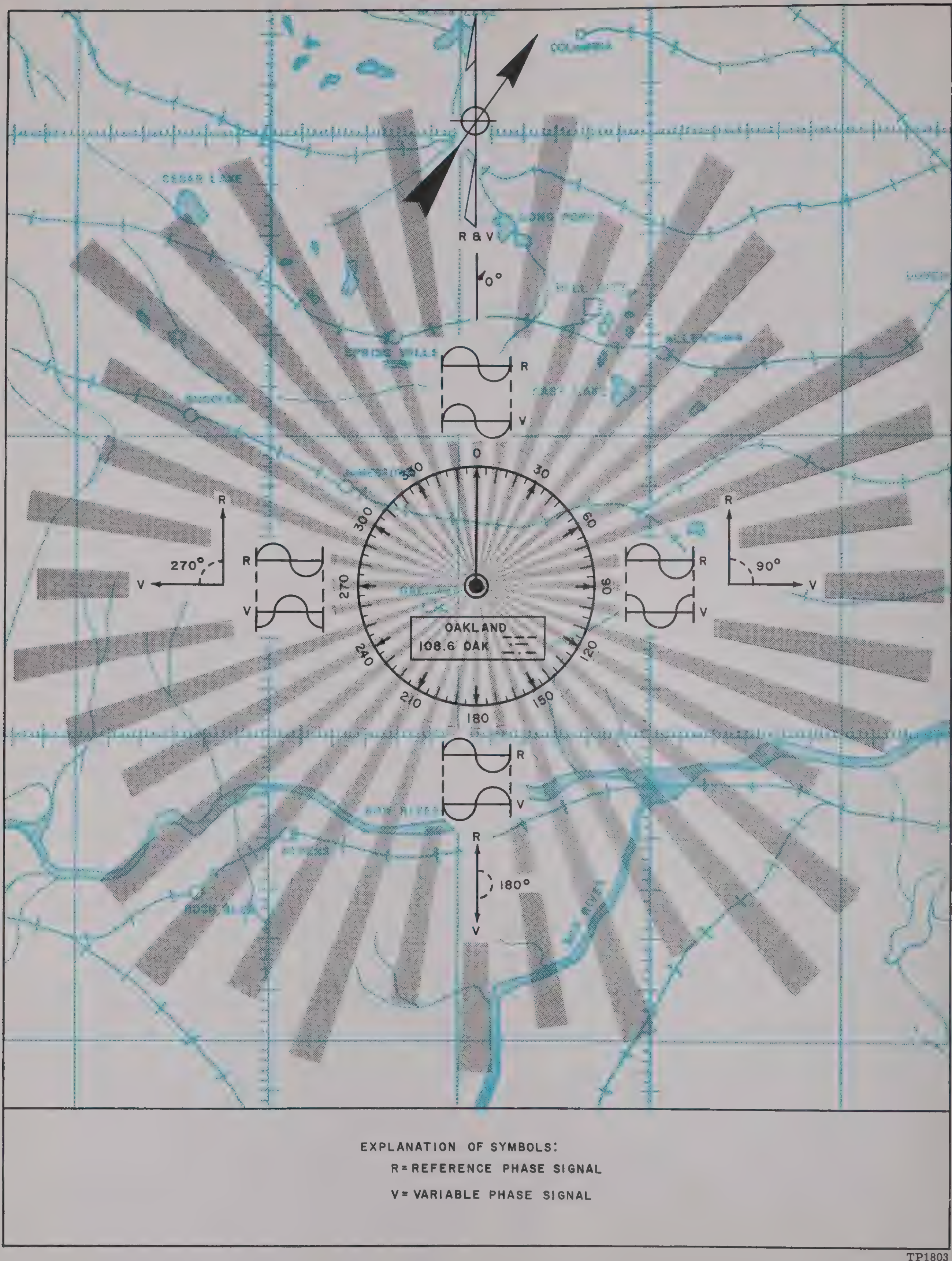


Figure 4–1. Phase Relationship of VOR Reference Phase and Variable Phase Signals

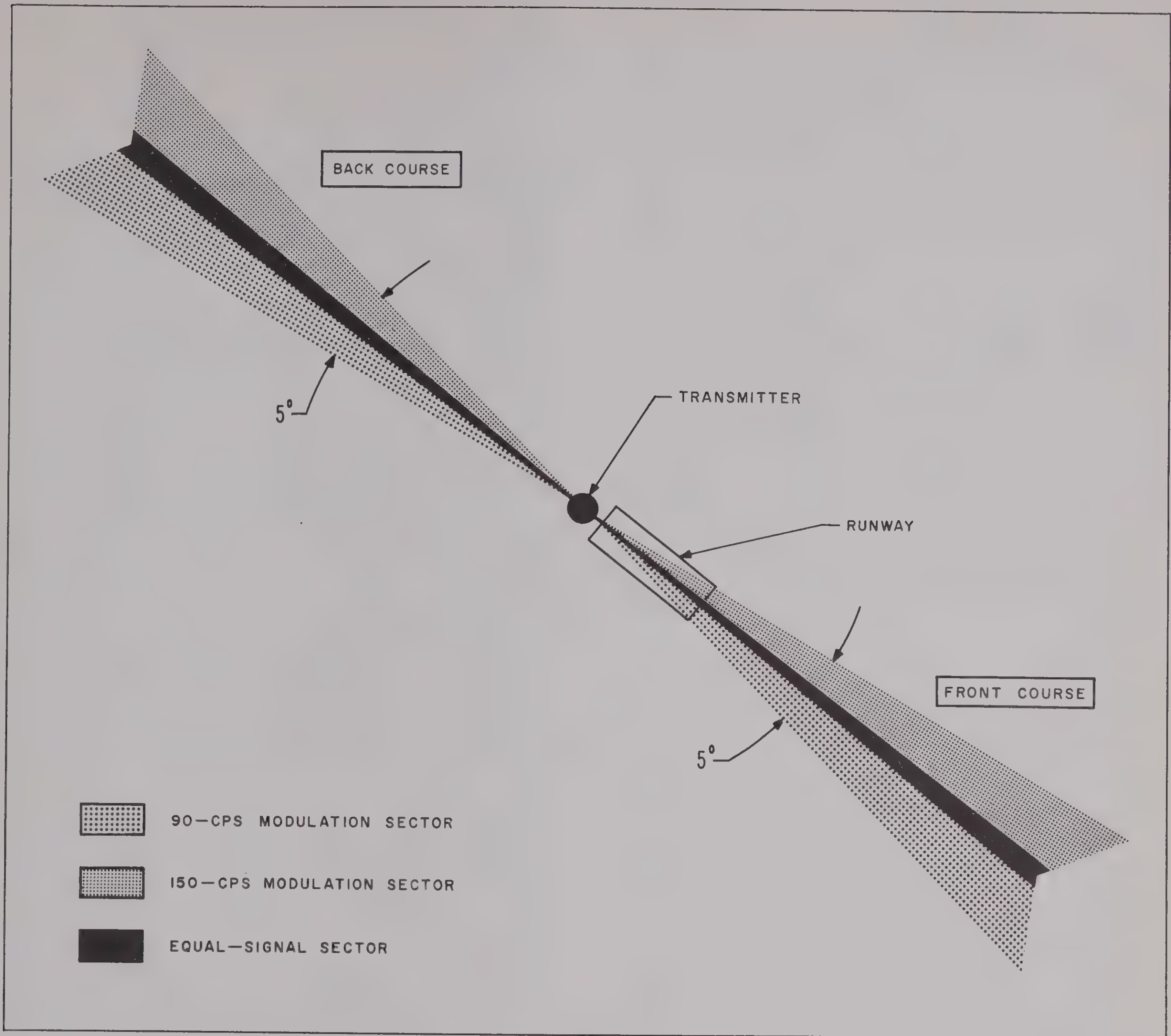


Figure 4–2. Localizer Beam Characteristics

TP1805

The type of navigation reception desired is selected automatically by the channel selector switches on the control unit. With these switches set to a VOR frequency, high voltage and the navigation portion of the VOR signal are fed through the E-14 Rack to the normally closed contacts of VOR-localizer relay K201 in the converter. The signal passes through the relay contacts and is applied to the variable channel and reference channel circuits of the B-13A-1. These circuits convert the signals into visual track information for presentation on the IN-10 Course Indicator. With the control unit channel selector switches set to a localizer frequency, receiver VOR-localizer switch A1S1 is actuated, and LV+ is applied through the switch to VOR-localizer relays K201 and K202. Application of LV+ energizes the relays. With relay K201 energized, high voltage and the navigation portion of the localizer signal are fed to the converter localizer circuits where the signal is converted for visual presentation on the vertical pointer of the IN-10. Flag information is fed from the localizer circuits to the flag circuits of the IN-10 when relay K202 is energized. The communication portion of the received signal is routed from the receiver through the E-14 Rack to the control unit, regardless of the condition of relays K201 and K202.

In addition to automatic VOR-localizer switching, the channel selector switches control the operation of an automatic audio-equalizing switch (A1S2) in the receiver. When tuned to a high-level-modulation communication frequency (118.00–126.90 mc), the receiver audio output is shunted by the switch. This shunting reduces the audio level to that obtained from low-level-modulation navigation signals (108.00–118.00 mc).

4–3. R-34A RECEIVER.

General. The R-34A Receiver is a crystal-controlled, airborne, navigation-communication receiver which operates in the frequency range of 108.00–126.90 mc. The R-34A is remotely operated by a control unit such as the ARC Type C-81A Control Unit, and furnishes the operator with a total of 190 channels spaced 100 kc apart. A detailed block diagram of the unit is shown in Figure 4–4; its schematic diagram is shown in Figure 6–1.

R-f signals between 108.00 and 126.90 mc are fed from the antenna through the double-tuned, r-f cascode amplifier to the first mixer. The output (96.3–114.3 mc) from the megacycle crystal oscillator-doubler is also fed to the first mixer to produce the first i-f signal of 11.7–12.6 mc. This signal passes through a double-tuned, i-f filter to the second mixer. The output (10.0–10.9 mc) from the fractional megacycle crystal oscillator is also fed to the second mixer to produce the second i-f signal of 1.7 mc. This second i-f signal is amplified by four double-tuned, i-f stages and is then demodulated by the detector-agc circuit.

The detected output is applied to three separate circuits: a cathode follower, a squelch control circuit, and a noise limiter. The cathode follower couples the navigation output of the R-34A to the B-13A-1 Converter. The noise limiter clips noise pulses and passes voice-communication signals to the first audio amplifier and squelch stage. When properly set, the current flowing through the squelch control tube is small, and the first audio amplifier conducts normally when a detector output is present. When no signal is received, or when the muting diode is conducting during channeling, increased current flowing through the squelch control tube cuts off the first audio amplifier. Further amplification of the voice signals is accomplished in the audio output stage, and the signal is then fed to the control unit for volume control and audio distribution.

The receiver frequency is selected through remote control of two pawl-driven, ratchet-rotated crystal drums. The megacycle drum contains 19 crystals, which determine the whole-megacycle portion of the channel received, while the fractional megacycle drum contains 10 crystals, which determine the tenth-megacycle portion of the channel received. A total of 190 channels with 100-kc spacing is provided.

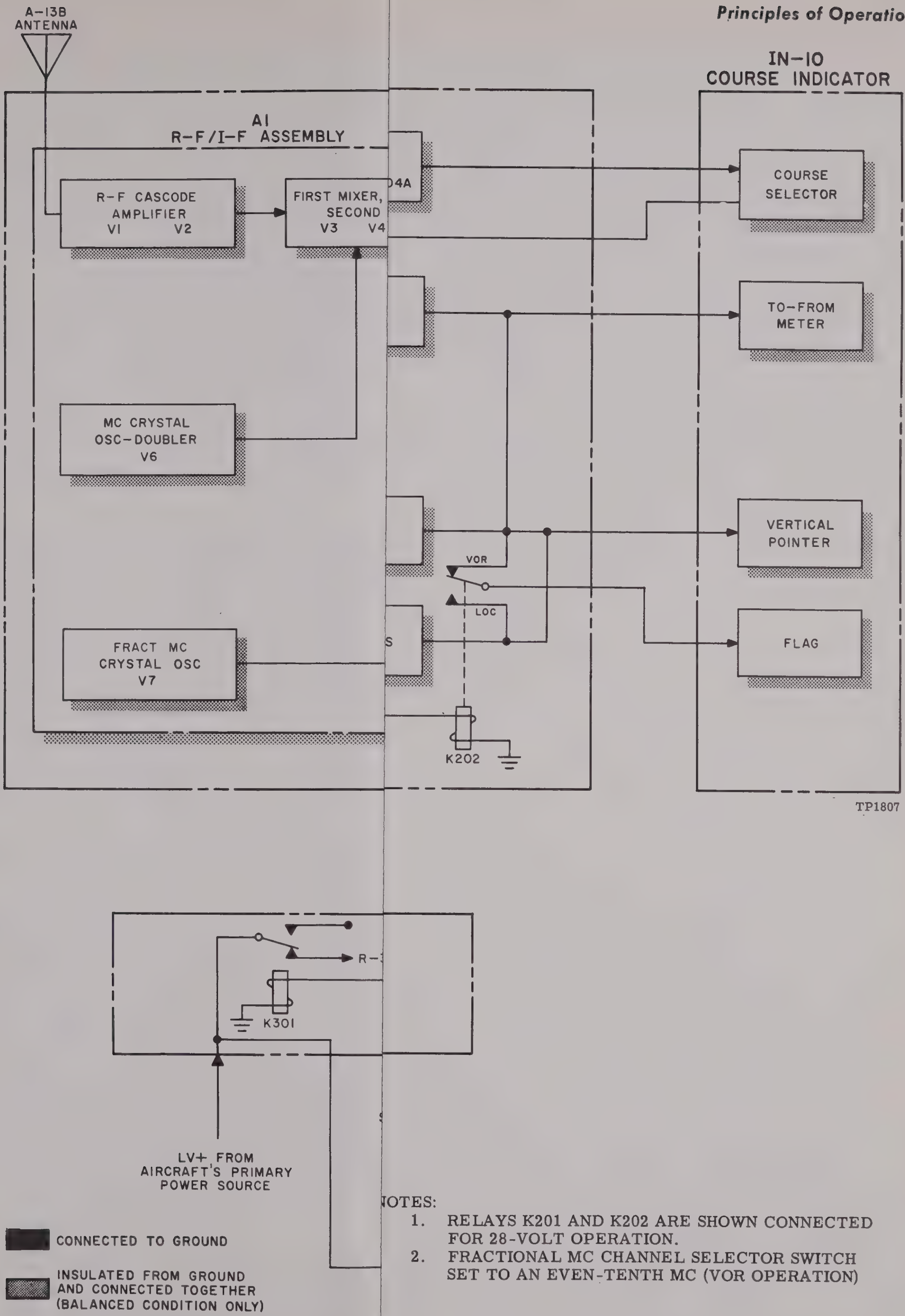
The tuned circuits of the r-f amplifier and megacycle oscillator-doubler are linked by a cam and tuning plate to the megacycle crystal drum. This mechanical arrangement provides continuous adjustment of the tuning circuits. Independent upper and lower frequency-limit adjustments in the circuits are used to align the receiver for optimum tracking. Another cam, driven by the fractional megacycle crystal drum, is linked to the tunable parts of the first i-f filter. These parts tune the filter to the desired intermediate frequency.

Crystal-saving Circuit. The receiver crystal-saving circuit uses 29 subminiature crystals to provide 190 channels. The crystals are located in two servo-controlled crystal drums: the megacycle crystal drum and the fractional megacycle crystal drum. The megacycle crystal drum, controlled by the megacycle channel selector switch on the control unit, contains 19 crystals spaced from 48.15–57.15 mc in 0.5-mc steps. When the selector switch is set to a desired channel, the megacycle crystal drum indexes to the crystal, the frequency of which is mixed with the received signal to produce the correct first intermediate frequency. The crystal determines the fundamental frequency of the oscillator. The fundamental frequency is doubled by tuning the output circuits of the oscillator-doubler to the second harmonic of the fundamental frequency. The first intermediate frequency (11.7–12.6 mc) is then produced in the first mixer stage by mixing the oscillator-doubler output signal and the output of the cascode amplifier. The output of the mixer stage contains sum and difference frequencies that are applied to the first i-f filter. The difference frequency (11.7–12.6 mc) is passed by the filter to the second mixer stage; all other frequencies are attenuated by the filter.

The second mixer produces the final if. of 1.7 mc by combining the filtered output of the first mixer with the output of the fractional megacycle crystal oscillator. The output frequency of the oscillator will vary in 0.1-mc steps between 10.0 and 10.9 mc, depending on the setting of the fractional megacycle channel selector switch. The second if. is produced by coupling the difference frequency (the first if. minus the fractional megacycle oscillator frequency) through a 1.7-mc i-f transformer to the first 1.7-mc i-f amplifier.

An example of frequency synthesis used in the R-34A and described in the preceding paragraphs follows:

Desired operating frequency	111.4 mc
Megacycle channel selector switch setting	111
Megacycle channel crystal frequency	49.65 mc
Crystal oscillator frequency	49.65 mc
Doubler output frequency	99.3 mc
First mixer difference frequency (first if.)	12.1 mc
Second mixer input frequency	12.1 mc
Fractional megacycle channel selector switch setting	.40
Fractional megacycle crystal frequency	10.4 mc
Fractional megacycle crystal oscillator output frequency	10.4 mc
Second mixer difference frequency (second if.)	1.7 mc



NOTES:

1. RELAYS K201 AND K202 ARE SHOWN CONNECTED FOR 28-VOLT OPERATION.
2. FRACTIONAL MC CHANNEL SELECTOR SWITCH SET TO AN EVEN-TENTH MC (VOR OPERATION)

Figure 4–3. Dual-unit-rack Installation, Functional Block Diagram

4–3. R-34A RECEIVER.

General. The R-34A Receiver is a crystal-controlled, airborne, navigation-communication receiver which operates in the frequency range of 108.00–126.90 mc. The R-34A is remotely operated by a control unit such as the ARC Type C-81A Control Unit, and furnishes the operator with a total of 190 channels spaced 100 kc apart. A detailed block diagram of the unit is shown in Figure 4–4; its schematic diagram is shown in Figure 6–1.

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The detected output is applied to three separate circuits: a cathode follower, a squelch control circuit, and a noise limiter. The cathode follower couples the navigation output of the R-34A to the B-13A-1 Converter. The noise limiter clips noise pulses and passes voice-communication signals to the first audio amplifier and squelch stage. When properly set, the current flowing through the squelch control tube is small, and the first audio amplifier conducts normally when a detector output is present. When no signal is received, or when the muting diode is conducting during channeling, increased current flowing through the squelch control tube cuts off the first audio amplifier. Further amplification of the voice signals is accomplished in the audio output stage, and the signal is then fed to the control unit for volume control and audio distribution.

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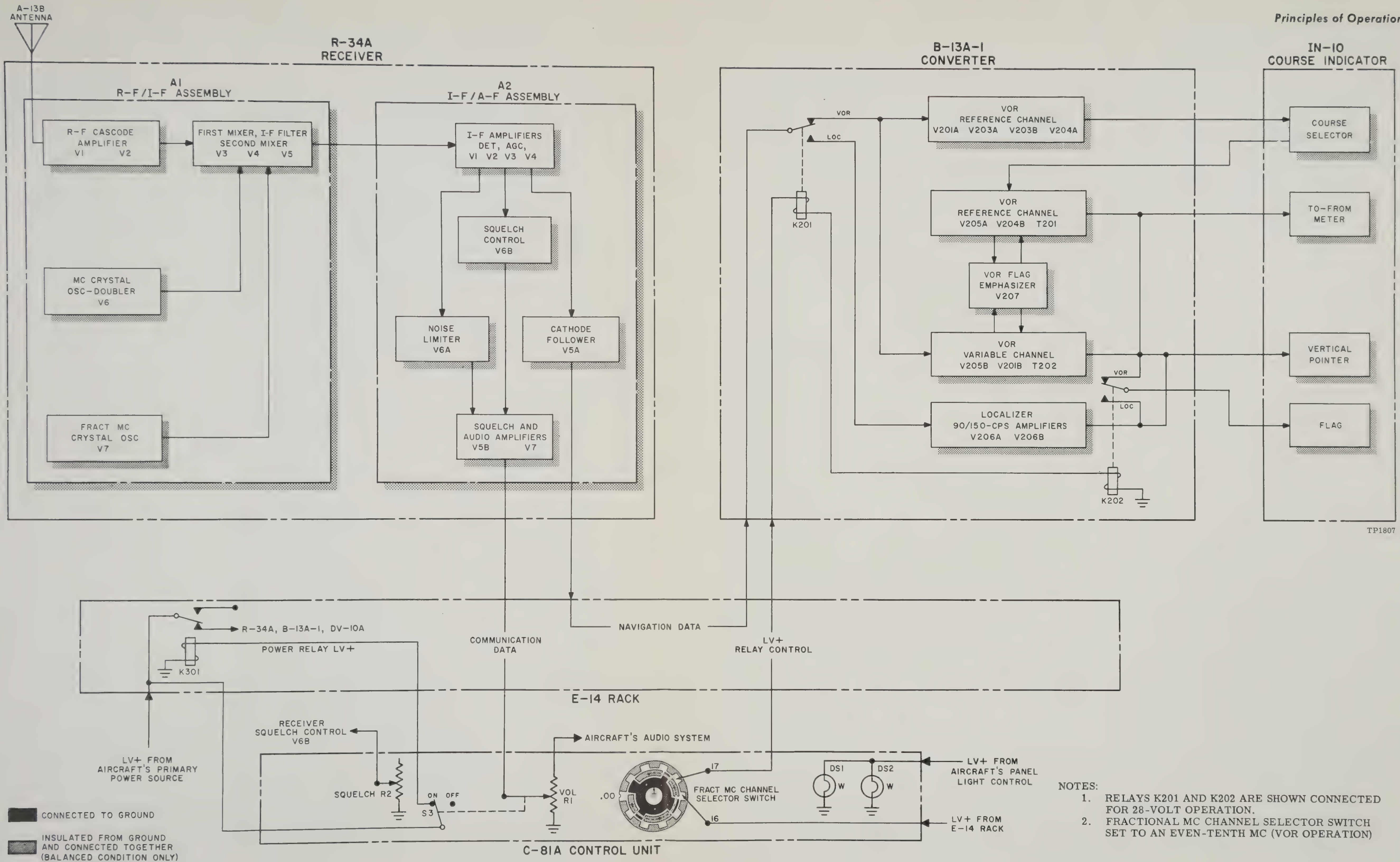
Second mixer input frequency	12.1 mc
Fractional megacycle channel selector switch setting	.40
Fractional megacycle crystal frequency	10.4 mc
Fractional megacycle crystal oscillator output frequency	10.4 mc
Second mixer difference frequency (second if.)	1.7 mc



NOTES:
1. RELAYS K201 AND K202 ARE SHOWN CONNECTED FOR 28-VOLT OPERATION.
2. FRACTIONAL MC CHANNEL SELECTOR SWITCH SET TO AN EVEN-TENTH MC (VOR OPERATION)

Figure 4–3. Dual-unit-rack Installation, Functional Block Diagram

Channel Selection. Channel selection is accomplished by using two five-wire, open-seeking, binary re-entrant switching circuits to control the operation of latching relays A3K1 and A3K2. The relays control the operation of the tuner assembly drive motor. When energized, each relay applies operating voltage to the motor and removes a mechanical lock from the drive-pawl lever associated with the relay. Application of voltage to the motor causes it to drive an eccentrically mounted cam. The cam is used to operate the pawl-and-ratchet mechanism associated with the energized relay. Figure 4–5 shows the megacycle channel selecting mechanism and its control circuits in a static (balanced) condition at 108 mc. The illustration is keyed to the following paragraphs which explain megacycle channel selection. Both the text and the illustration may also be applied to the principles of operation of the fractional megacycle channel selection mechanism. Refer to Figure 4–6 for the complete binary code.

In the static condition shown in Figure 4–5, the megacycle channel drive pawl is locked in its "home" position by the latching lever on the deenergized latching relay, and the five-wire switching circuit is in a balanced condition. As shown in the illustration, wires 1 and 2 are grounded at both the selector switch end and the top plate end, and wires 3, 4, and 5 are shorted together by both switches. With this switching arrangement, relay A3K2 is deenergized since its ground lead is connected to the shorting section of the top plate and the shorting section is not grounded. When the relay is deenergized, the amount of releasing spring-tension is small, and the latching lever is held by, and in turn holds, the drive-pawl lever in its home position. This combined holding action is due to the pressure exerted by the lever spring on the drive-pawl lever. A reverse-locking pawl (not shown in the illustration) is used to prevent counterclockwise rotation of the ratchet. The pawl is spring-loaded to its home position at all times. The index plate is connected by a shaft to the crystal drum and by springs to the ratchet. Rotation of the ratchet, therefore, results in similar rotation of the index plate and the crystal drum. Although the ratchet is locked in its home position, the index plate would be free to move slightly, due to the spring coupling, if it were not locked. As shown in the illustration, the indexing pin on the index-lock arm locks the index plate in position. This locking insures proper contact between the crystal pins and the wiper contacts of the oscillator-doubler stage.

The balanced condition is upset when the megacycle channel selector switch is set to a new frequency, for example, 111 mc. Table 1 of Figure 4–5 shows the difference in the condition of the switch and plate contacts immediately after the switch position is changed. As shown, the top plate contacts remain as they were in the balanced condition since the plate is still at its 108-mc setting. On the switch, however, two wires (3 and 4) that were previously shorted are now connected to ground. This new combination grounds the shorting section of the top plate, applying a ground to the relay coil, thereby energizing the relay.

Energizing latching relay A3K2 spring-loads the latching lever to apply releasing pressure and connects LV+ through the energized relay contacts to the motor. The motor rotates the drive cam against the drive-pawl lever, releasing the spring-loaded latching lever. With the lever released, the drive-pawl lever and the index-lock arm are free to move away from the ratchet and the index plate, respectively, as the eccentrically mounted drive cam rotates. Rotation of the drive cam permits the drive-pawl lever to move to its maximum outward position, at which point the drive pawl indexes against the next ratchet tooth. Continued rotation of the drive cam moves the drive-pawl lever and the index-lock arm back to their home positions. As the drive-pawl lever moves inward, it rotates the ratchet, which in turn rotates the index plate. Since the crystal drum is connected to the index plate, the drum and its top plate move to a new position. If this new position results in a matching of the top plate switching code with that of the channel selector switch, the ground is removed from the relay, the latching lever locks the drive-pawl lever in the home position, and the motor stops. If the top plate switching code does not match the channel selector code, the operating cycle of the drive-pawl lever is repeated until the codes agree.

Megacycle Channel Tuning. Main (megacycle) tuning of the receiver is accomplished by variable, air-dielectric, butterfly-type capacitors, each mounted in a separate compartment and mechanically linked by a tuning plate (see Figure 4–7). The capacitors provide correct tracking for the r-f amplifier and crystal-oscillator doubler stages. A tuning arm assembly is mounted on the rotor shaft of each variable capacitor. At the end of each assembly is a bronze bushing. Each bronze bushing is spring-loaded against the tuning plate so that the bushing and the attached tuning capacitors will follow the movement of the plate. The position of the tuning plate is determined by the position of a heart-shaped cam mounted on the megacycle crystal drum shaft. The length of each tuning arm assembly is adjustable so that, for a fixed movement of the tuning plate, the angle of rotation of each capacitor shaft is independently adjustable. The capacitors are adjusted by rotating the capacitor shaft with respect to its tuning arm. For optimum tuning, the capacitor is peaked at 126 mc and the arm length is adjusted at 108 mc.

Fractional Megacycle Channel Tuning. Fractional megacycle tuning is accomplished by slug-tuning the i-f filter

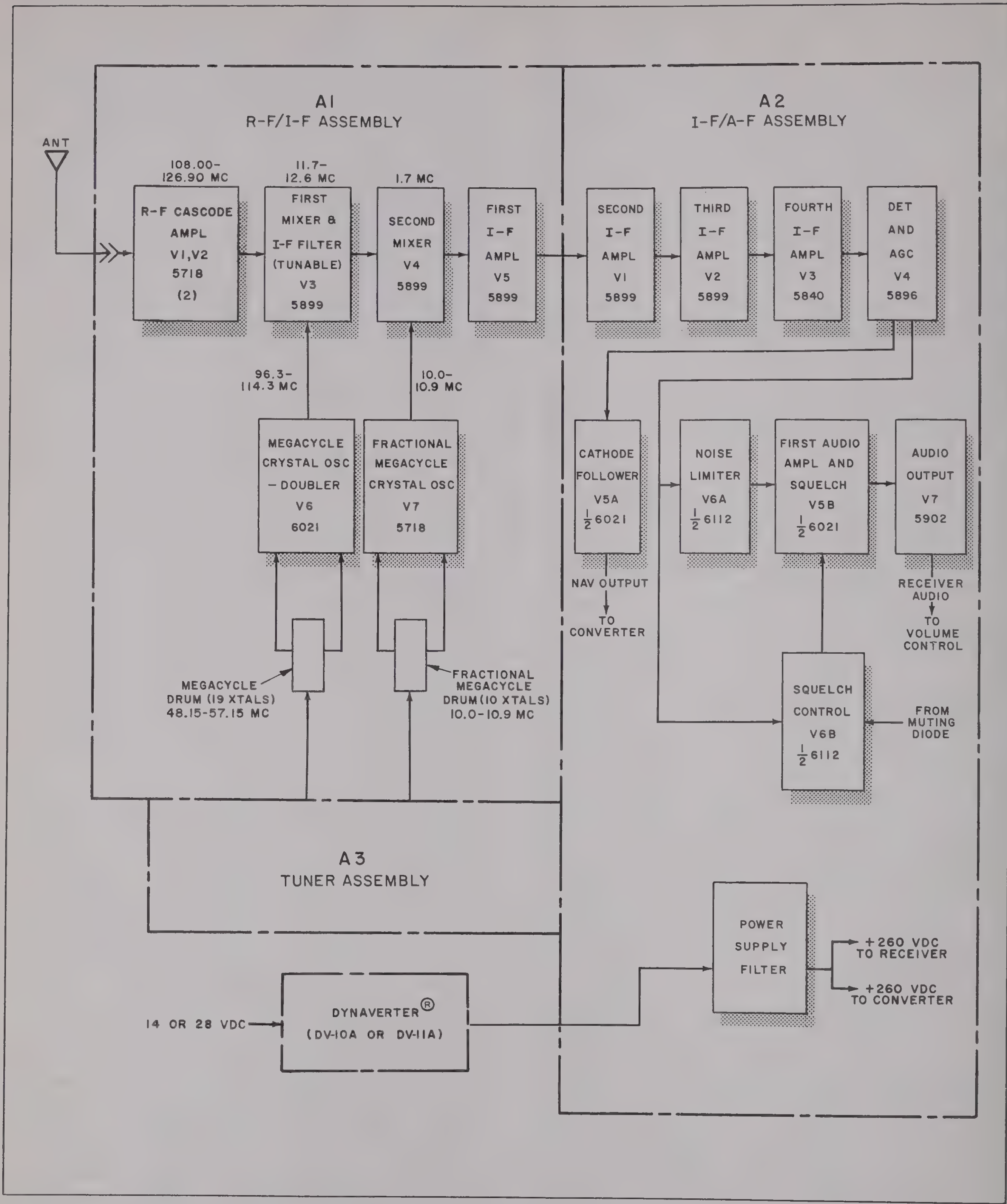
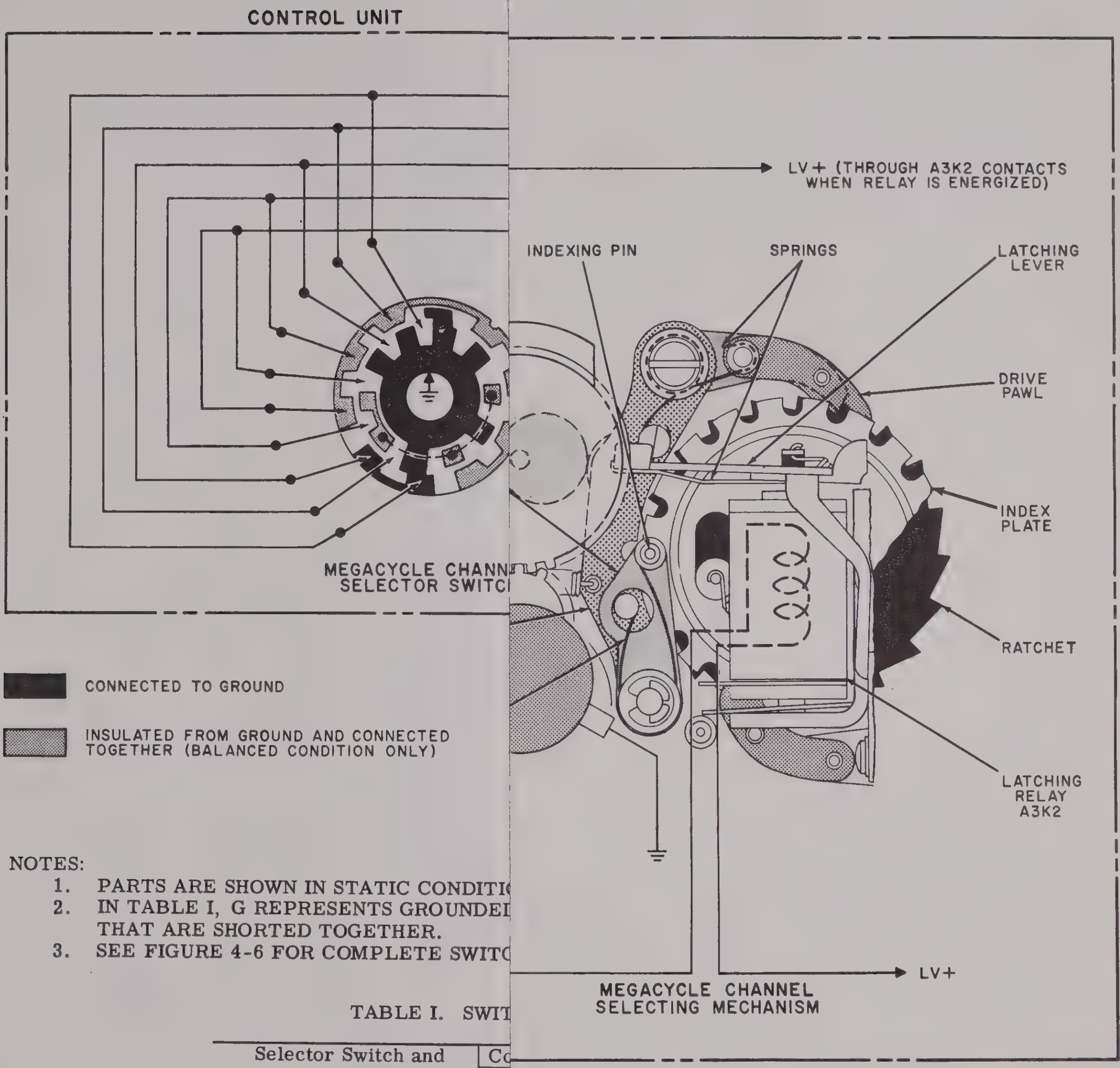


Figure 4–4. R-34A Receiver, Block Diagram TP1621

in the output circuit of the first mixer, A1V3. The ferrite cores which tune the two coils (A1L5 and A1L6) in the first i-f filter are cam driven by a shaft which is geared to the fractional megacycle crystal drum (see Figure 4–8). The cores are spring-loaded to prevent unintentional rotation of their threaded shafts, but they may be turned with a small capstan wrench to increase or decrease their penetration into the coil.



NOTES:
1. PARTS ARE SHOWN IN STATIC CONDITI
2. IN TABLE I, G REPRESENTS GROUNDEI
   THAT ARE SHORTED TOGETHER.
3. SEE FIGURE 4-6 FOR COMPLETE SWITC

TABLE I. SWIT

Selector Switch and Top Plate Positions	Co 1
BALANCED C	
Selector Switch - 108 mc	C
Top Plate - 108 mc	C
UNBALANCED	
Selector Switch - 111 mc	C
Top Plate - 108 mc	C

Figure 4–5. Megacycle Channel Selection Mechanism and Associated Control Circuits, Functional Diagram

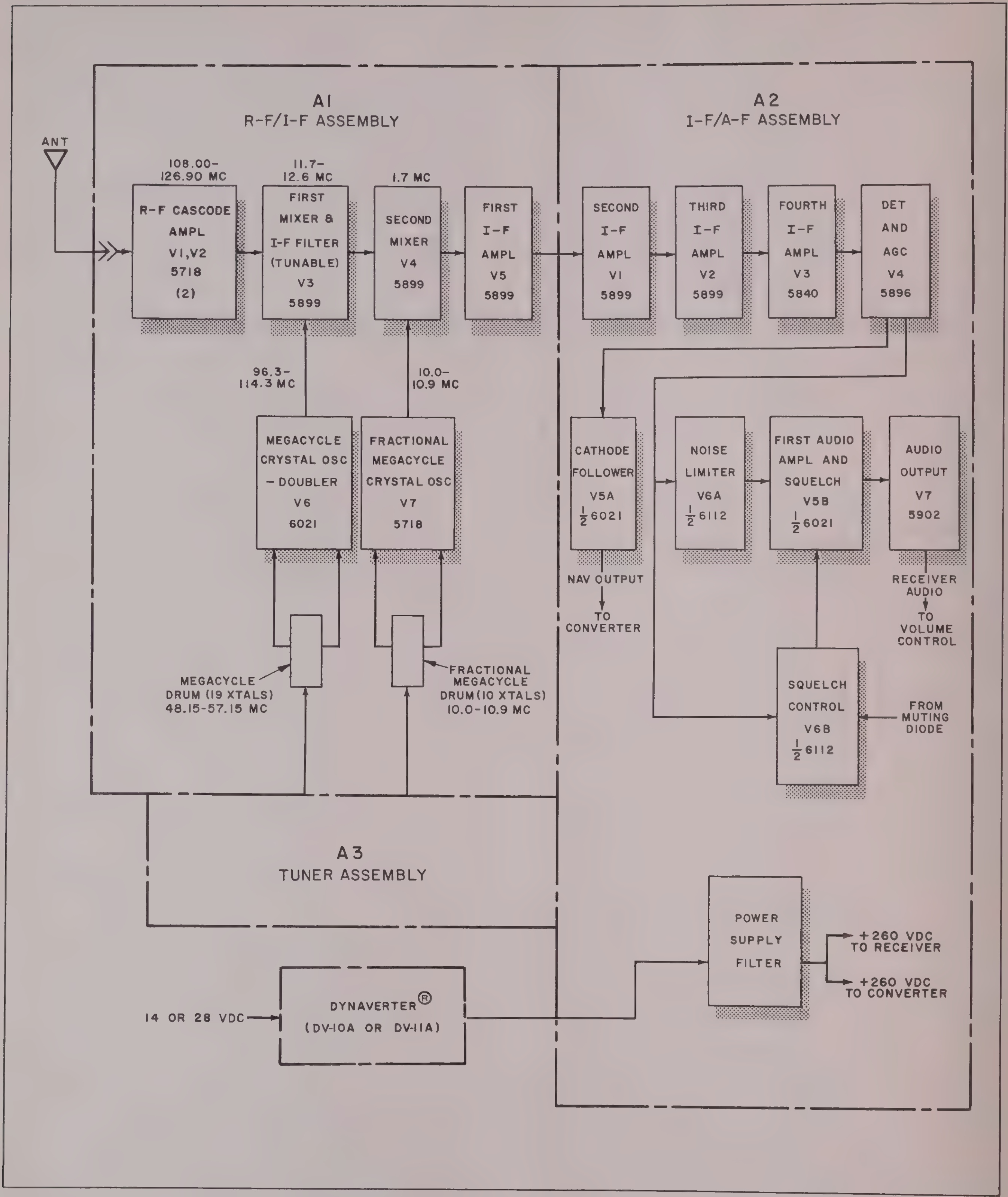
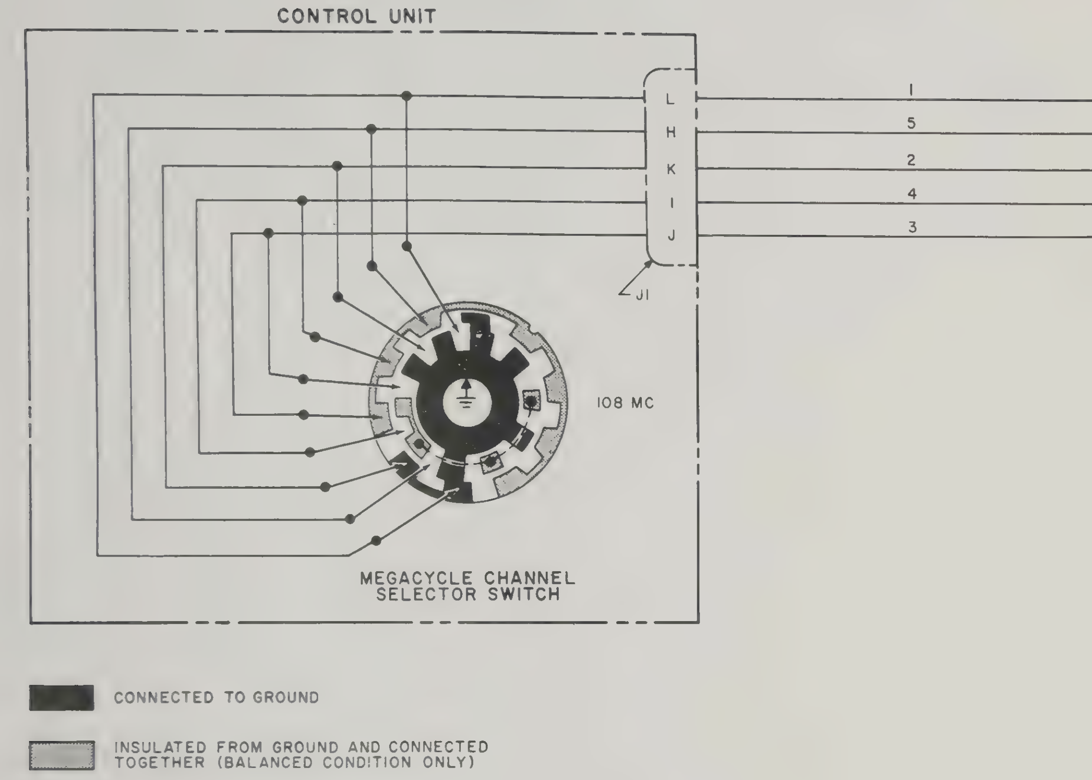
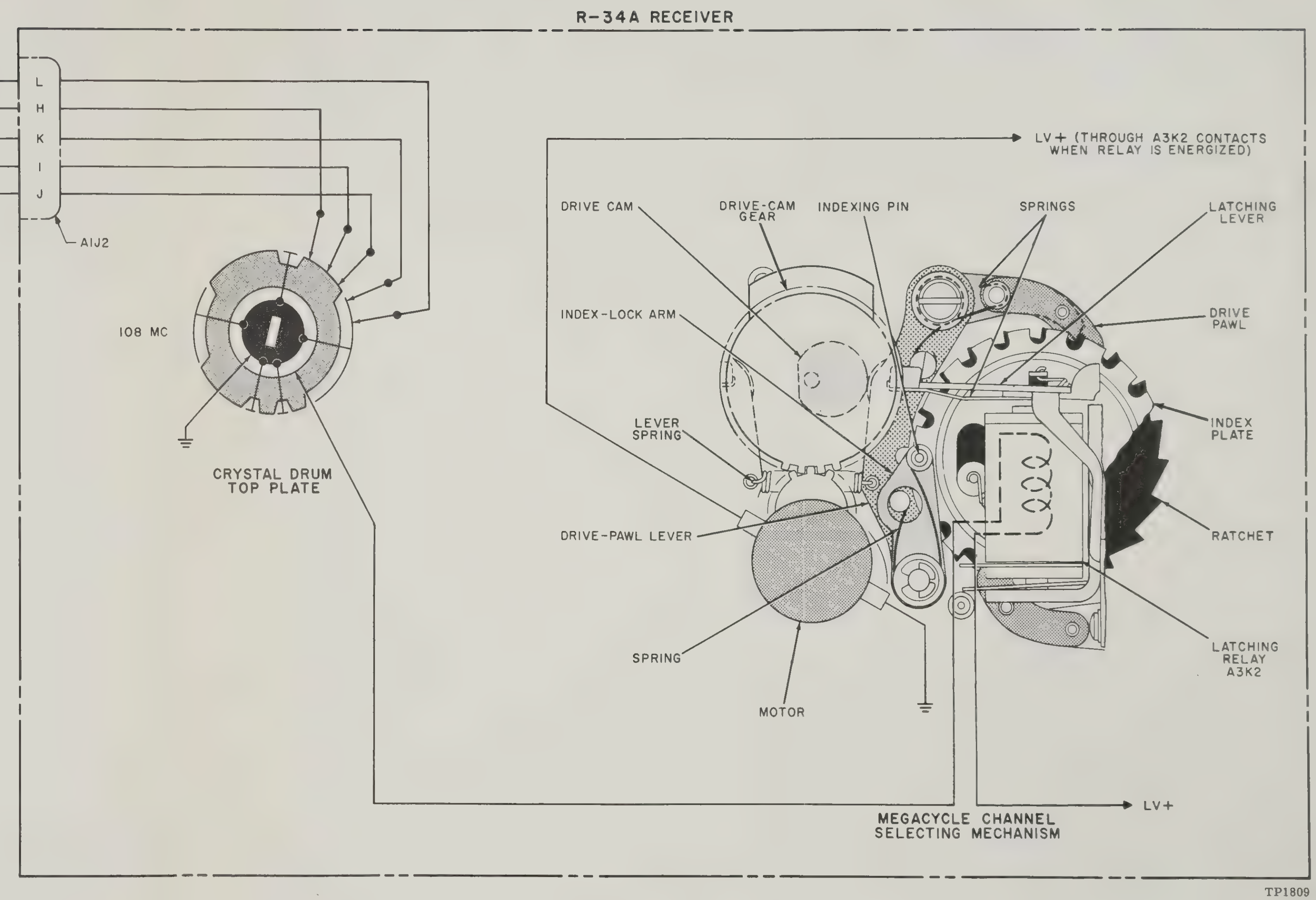


Figure 4–4. R-34A Receiver, Block Diagram TP1621

in the output circuit of the first mixer, A1V3. The ferrite cores which tune the two coils (A1L5 and A1L6) in the first i-f filter are cam driven by a shaft which is geared to the fractional megacycle crystal drum (see Figure 4–8). The cores are spring-loaded to prevent unintentional rotation of their threaded shafts, but they may be turned with a small capstan wrench to increase or decrease their penetration into the coil.





NOTES:
1. PARTS ARE SHOWN IN STATIC CONDITION.
2. IN TABLE I, G REPRESENTS GROUNDED TERMINALS AND X REPRESENTS TERMINALS THAT ARE SHORTED TOGETHER.
3. SEE FIGURE 4-6 FOR COMPLETE SWITCHING CODE.

TABLE I. SWITCHING CODE

Selector Switch and Top Plate Positions	Condition of Control Wires				
	1	2	3	4	5
BALANCED CONDITION					
Selector Switch - 108 mc	G	G	X	X	X
Top Plate - 108 mc	G	G	X	X	X
UNBALANCED CONDITION					
Selector Switch - 111 mc	G	G	G	G	X
Top Plate - 108 mc	G	G	X	X	X

Figure 4–5. Megacycle Channel Selection Mechanism and Associated Control Circuits, Functional Diagram

R-34A RECEIVER SWITCHING SEQUENCE

CRYSTAL DRUM POSITION		CONTROL WIRE NUMBER (SEE NOTE)				
MC	FRACT MC	1	2	3	4	5
108	.00	■	■	□	□	□
109		■	■	■	□	□
110	.10	■	□	□	□	■
111		■	■	■	■	□
112	.20	□	□	□	■	□
113		□	■	■	■	■
114	.30	□	□	■	□	□
115		■	□	■	■	■
116	.40	□	■	□	□	□
117		□	■	□	■	■
118	.50	■	□	□	□	□
119		■	□	■	□	■
120	.60	□	□	□	□	■
121		□	■	□	■	□
122	.70	□	□	□	■	■
123		□	□	■	□	■
124	.80	□	□	■	■	□
125		■	□	□	■	□
126	.90	□	■	■	□	□
BLANK		■	■	□	□	■

■ CONNECTED TO GROUND

□ INSULATED FROM GROUND AND CONNECTED TOGETHER

NOTE: NUMBERS REFER TO WIRES IN MEGACYCLE AND FRACTIONAL MEGACYCLE FIVE-WIRE CHANNEL-SELECTOR SWITCHING CIRCUITS.

Figure 4–6. Binary Code Switching Sequence, Simplified Schematic Diagram

TP1811

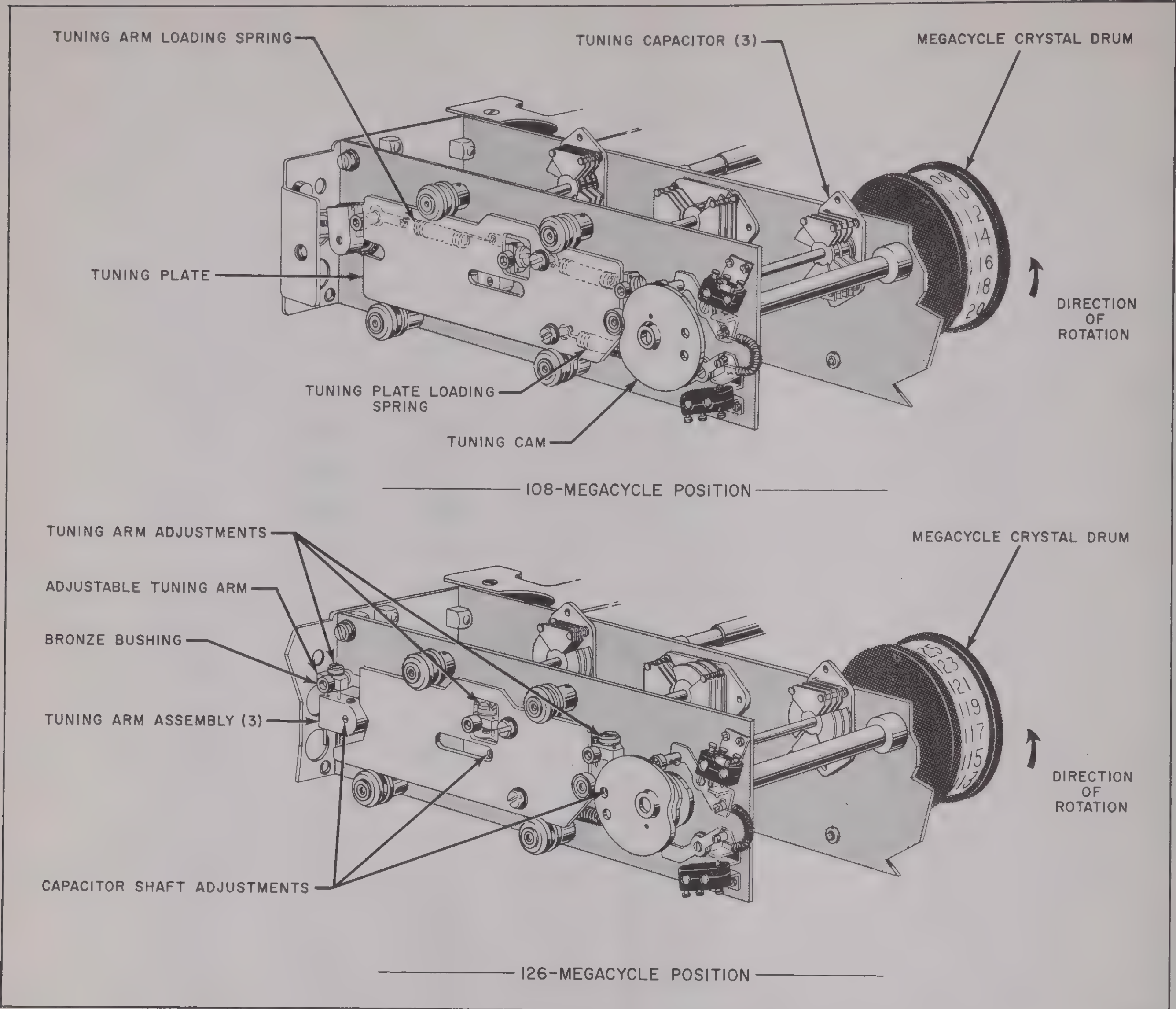


Figure 4–7. Megacycle Tuning Mechanism, Functional Diagram TP1813

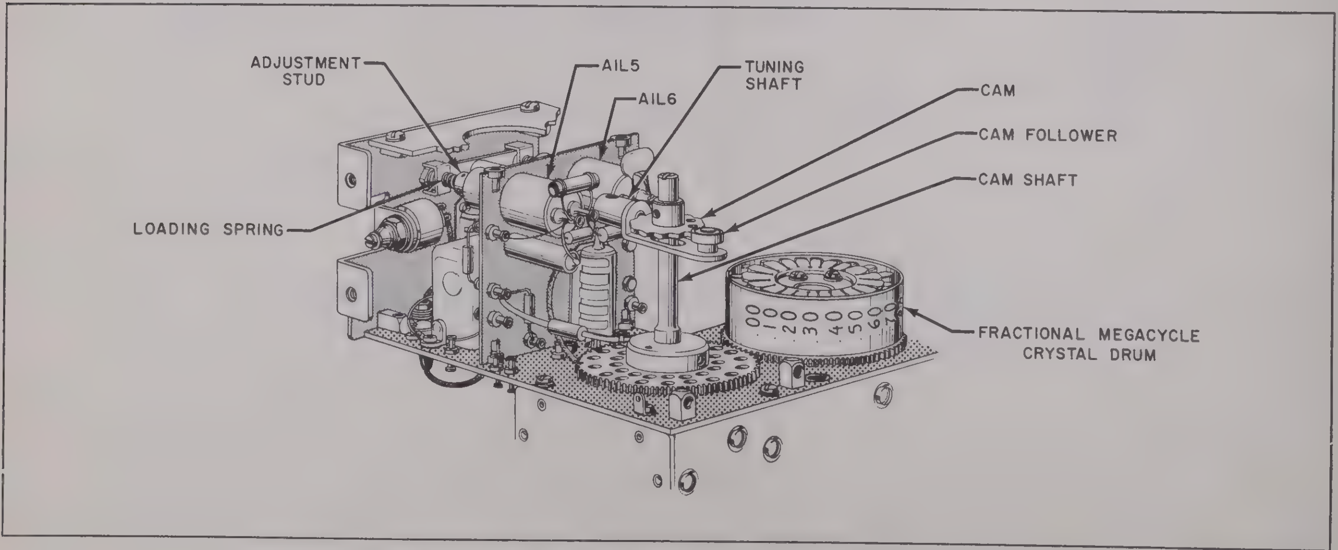


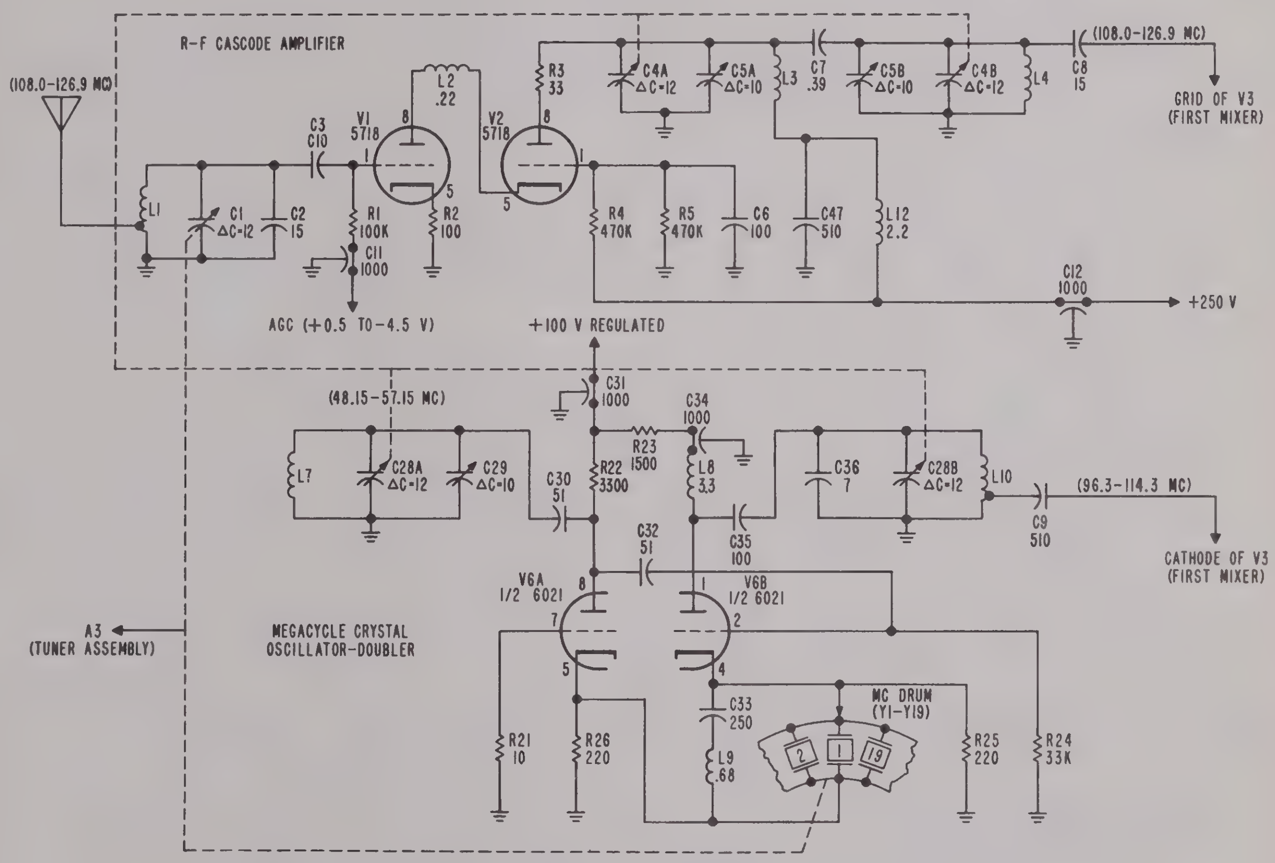
Figure 4–8. Fractional Megacycle Tuning Mechanism, Functional Diagram TP1815

Receiver Circuit Details.

R-F CASCODE AMPLIFIER. As shown in Figure 4–9, the r-f amplifier is a series, d-c coupled, cascode circuit using two 5718 triode tubes, V1 and V2. The cascode circuit, which provides the high input circuit gain of a pentode and the low-noise characteristics of a triode, employs a tuned input circuit and a double-tuned output circuit. Both tuned circuits are linked to the megacycle channel tuning mechanism. When a new channel is selected by the megacycle channel selector switch on the control unit, the megacycle crystal drum is indexed to the correct crystal position, and the tuned circuits are adjusted to pass the desired frequency. The signal (108.0–126.9 mc) received by the antenna is inductively coupled to the r-f amplifier by a low-impedance tap on L1. The r-f signal is amplified by V1 and V2 and applied to the grid of the first mixer, V3, through the double-tuned bandpass output circuit.

MEGACYCLE CRYSTAL OSCILLATOR-DOUBLER. The megacycle crystal oscillator-doubler uses a 6021 twin triode, V6, in a Butler, cathode-coupled, series-mode, crystal oscillator-doubler circuit (see Figure 4–9). The function of this stage is to generate the megacycle r-f injection signal for the first mixer, V3. Depending upon the setting of the megacycle channel selector switch in the control unit, one of 19 subminiature crystals mounted on the receiver megacycle crystal drum is connected between the cathodes of V6. (Each crystal is designed to operate at series resonance on the third overtone mode.) The first triode, V6A, is connected as a grounded-grid amplifier; the second triode, V6B, is connected as a split-load cathode follower and frequency doubler.

Frequency doubling is accomplished by tuning the plate circuit of V6B to the second harmonic (96.3–114.3 mc) of the crystal frequency. The output of the doubler, taken from the low-impedance tap on L10, is coupled to the cathode of the first mixer by capacitor C9.



NOTES:

1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.
4. INDUCTANCE VALUES ARE IN MICROHENRIES (μH), UNLESS OTHERWISE NOTED.

TP1817

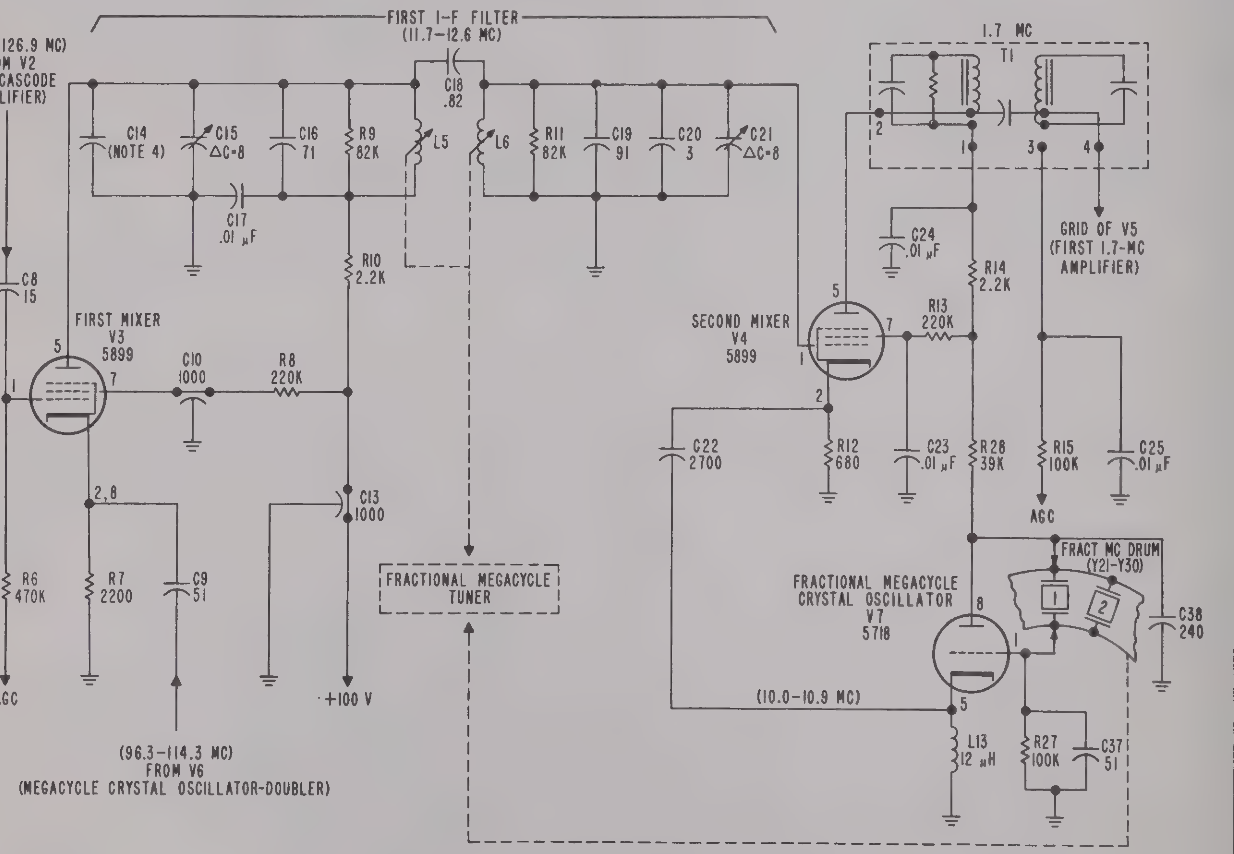
Figure 4–9. R-f Cascode Amplifier and Megacycle Crystal Oscillator-Doubler, Schematic Diagram

FIRST MIXER. The first mixer, V3, employs a 5899 pentode (see Figure 4–10). The r-f signal output (108.0–126.9 mc) of the cascode amplifier is coupled to the grid of V3 while the injection frequency (96.3–114.3 mc) provided by the megacycle crystal oscillator-doubler is coupled to the cathode of V3. The injection frequency beats in the mixer with the received signal frequency to produce a first if., which is variable from 11.7 to 12.6 mc. The plate of the first mixer is connected to the double-tuned, first i-f filter, which passes the i-f signal.

FIRST I-F FILTER. The first i-f filter (see Figure 4–10) is a double-tuned circuit connected between the first mixer, V3, and the second mixer, V4. The function of the filter is to provide bandpass fractional megacycle tuning of the first i-f signal. Tuning of the filter is accomplished by slug-tuning the two circuits over the frequency range of 11.7–12.6 mc. The tuning slug shaft is driven by a cam which is geared to the fractional megacycle crystal drum.

FRACTIONAL MEGACYCLE CRYSTAL OSCILLATOR. Tube V7, a 5718 triode, generates frequencies between 10.0 and 10.9 mc in 0.1-mc steps (see Figure 4–10). Connected as a conventional Pierce crystal oscillator, the stage develops a stable injection frequency for the second mixer. The frequency of the oscillator is controlled by the crystals which are inserted between the grid and plate of the tube. The method of selecting the desired crystal is described in *Channel Selection* of paragraph 4–3.

SECOND MIXER. The second mixer, V4, is a 5899 pentode (see Figure 4–10). The output of the first i-f filter (11.7–12.6 mc) is coupled to the grid of V4 while the injection frequency (10.0–10.9 mc) obtained from the fractional megacycle crystal oscillator is coupled to the cathode of V4. The first i-f signal beats with the injection frequency to produce the second i-f signal of 1.7 mc. The output of the second mixer is coupled to the first 1.7-mc amplifier, V3, by a double-tuned, 1.7-mc i-f transformer, T1, which is pretuned and hermetically sealed.



NOTES:

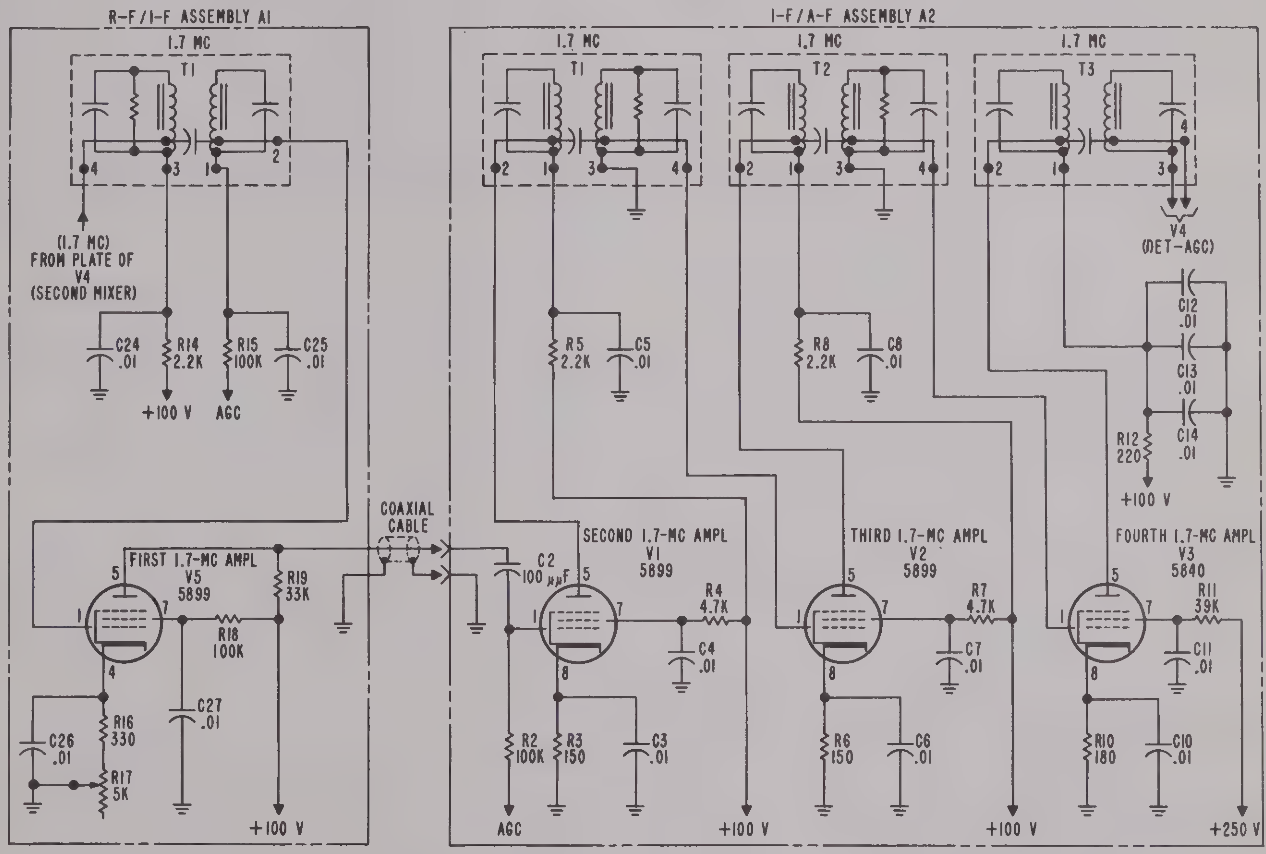
1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.
4. VALUE DETERMINED DURING FACTORY ALIGNMENT.

Figure 4–10. Mixers, First I-f Filter, and Fractional Megacycle Crystal Oscillator, Schematic Diagram TP1819

1.7-MC I-F AMPLIFIER STAGE. Three 5899 pentodes and one 5840 pentode are used as 1.7-mc i-f amplifiers. The first amplifier is V5 of the r-f/i-f assembly, A1 (see Figure 4–11). The remaining three 1.7-mc amplifiers are V1, V2, and V3 of the i-f/a-f assembly, A2. As shown in Figure 4–11, interconnection of the signal circuits of assemblies A1 and A2 is made through a miniature coaxial cable.

The output of the second mixer, A1V4, is coupled through i-f transformer A1T1 to the grid of the first 1.7-mc amplifier, A1V5. The transformer is tuned to pass the difference frequency (1.7 mc) of the second mixer and attenuate all other frequencies. The secondary of A1T1 is tapped for optimum impedance matching to the grid of A1V5; the low side of the secondary is connected to the agc circuit through a decoupling circuit consisting of A1R15 and A1C25. Variable resistor A1R17 is used to control the over-all i-f gain by controlling the cathode bias of the tube. The output of the first i-f amplifier is coupled to the second i-f amplifier, A2V1, where it is amplified and applied to the third i-f amplifier, A2V2. Tubes A2V1 and A2V2 are standard i-f voltage amplifiers. Their operation is similar, except that A2V1 is agc-controlled while A2V2 is not.

The output of the fourth 1.7-mc i-f amplifier, A2V3, is applied through transformer A2T3 to the detector-agc tube, A2V4. The parallel combination of capacitors A2C12, A2C13, and A2C14 is connected to the primary of A2T3 to reduce the effects of modulation rise, inherent in agc-controlled receivers.



NOTES:

1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.

TP1821

Figure 4–11. I-f Amplifiers (1.7 mc), Schematic Diagram

DETECTOR. The detector, a 5896 twin diode, is used for constant phase-shift detection of VOR and localizer signals, for detection of communication signals, and for the development of agc voltage (see Figure 4–12).

The output of the final 1.7-mc i-f amplifier, V3, is applied through the final i-f transformer to the navigation portion (A) of series-connected diode V4. The positive portion of the i-f signal causes V4A to conduct at a rate proportional to the amplitude of the i-f signal. R14 and R17 form the diode load and, with C16 and C17, form a dual-section, low-pass filter network to filter the i-f component from the navigation output signal. C19 is a cathode bypass capacitor which places the cathode of V4A at signal-ground potential. R13 and R44 are used to control the phase of the 30-cps navigation output. This phase shift, which is caused by the time constants of the detector circuit and the agc circuit, causes the navigation output signal to lead the modulation envelope by approximately 192° when the output line is open-circuited. The value of R44 is selected at the factory to produce an open-circuit phase shift of exactly 192°.

Caution

> The precision of this factory adjustment is greater than that which can be achieved elsewhere. It is recommended that no field adjustments be made. Parts which affect the phase shift are capacitors C16, C17, C18, and C19, resistors R13 and R14, and i-f transformer T3. If one or more of these parts are changed, the receiver should be tested as outlined in Table 5–3 and, if necessary, the receiver should be returned to the factory for precise adjustment.

The communication and agc detector, V4B, develops an audio output voltage that is proportional to the amplitude of the i-f signal. The detected output, filtered by the low-pass filter circuit consisting of R22, C22, and R26, is applied to the first audio amplifier, V5B.

When a carrier is present, a voltage, the magnitude of which varies proportionally with the strength of the received signal, is developed across C18 (see Figure 4–12). This voltage, which has the polarity shown in the illustration, is added algebraically to the +68 volts maintained by the voltage regulating action of Zener diode[1] CR4. The sum of the two voltages produces a delayed agc voltage of from +0.5 to −4.5 volts, depending on the strength of the received signal.

The delayed agc voltage is applied to the r-f and i-f amplifiers and to the first mixer to control the gain of the receiver. Agc clamping diode CR3 prevents the agc line from rising above +0.5 volt in the absence of a carrier.

[1] The Zener diode is a two-way device which functions as a normal diode in the forward current direction and as an opposite-polarity diode in the reverse current direction when the reverse breakdown (Zener) voltage is exceeded.

Resistor R45 is adjusted at the factory to set the agc delay time. Agc decoupling resistor R9 is shunted by diode CR2 to allow rapid changes in agc potential to occur while forcing ripple voltages and agc voltages of less than 0.5 volt to pass through the delaying filter composed of C9, R9, and C15.

CATHODE FOLLOWER. Cathode follower V5A provides a low-impedance, low-level navigation signal for the B-13A-1 Converter. The stage isolates navigation detector V4A from the B-13A-1 to minimize phase shift due to the variable-load effect of the converter. It also provides a second isolated output, suitable for connection to a 0- to 1-ma tuning meter during test.

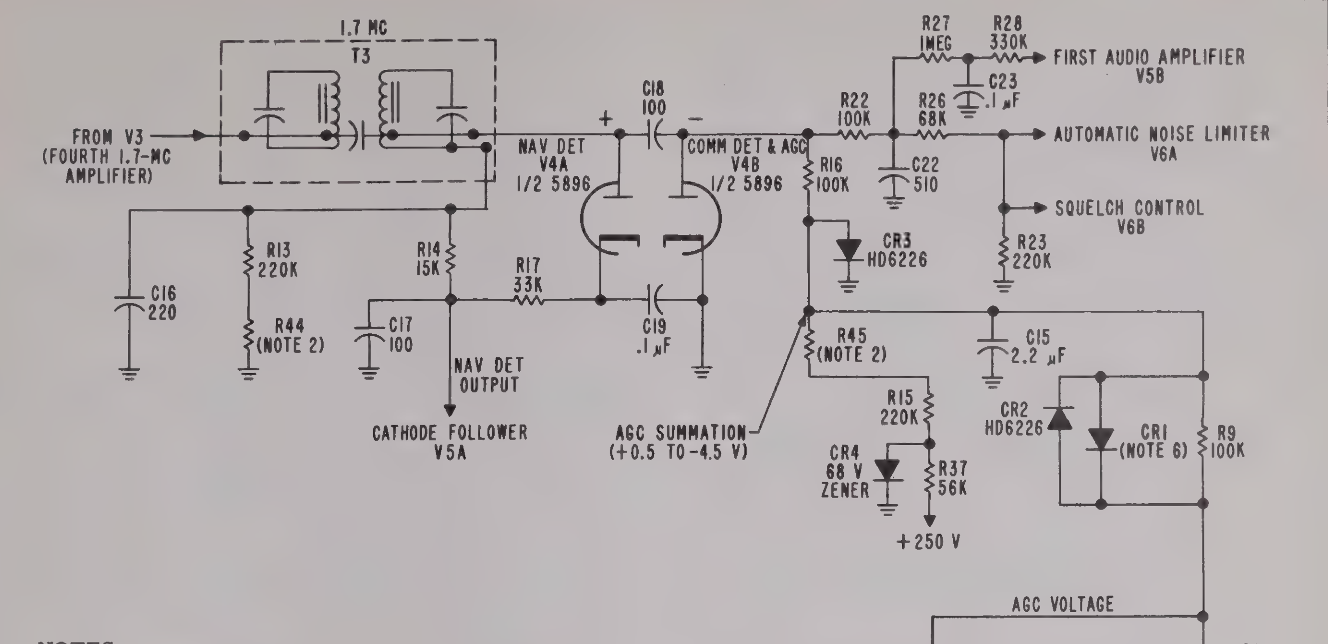
NOISE LIMITER. The automatic noise limiter, V6A, is used as a series-type limiter (see Figure 4–13). Due to the action of the detector, the limiter is normally conducting. When an unmodulated carrier is received, the current flow through V6A will be constant; the voltage drop across R29 will also be constant and will have the polarity shown in the illustration. When the carrier is modulated, the audio signal passes through the limiter, which appears as a low resistance when conducting, and is developed across R29. The voltage impressed across R29 is coupled to the grid of the first audio amplifier, V5B.

During a burst of noise, the voltage at point A of Figure 4–13 becomes instantaneously negative with respect to point B, and V6A is cut off. Since current flow through the tube stops, the noise pulse is not developed across R29. C23 tends to maintain the voltage at point C at the average level of the applied audio during the time that V6A is cut off. After the noise pulse ends, the tube again conducts.

SQUELCH CONTROL STAGE. The squelch control stage uses one-half (B) of a 6112 twin triode, V6, to control the first audio and squelch tube, V5B. Control is accomplished by varying the bias voltage on V5B to cut the tube off in the absence of a carrier.

The plate of V6B is direct-coupled through R32 to the grid of V5B. As shown in Figure 4–13, the grid of V5B and the plate of V6B are at the same d-c potential (38 or 68 volts). In the absence of a carrier, the voltage on the grid of the squelch control tube is approximately 6 volts dc and the tube conducts.

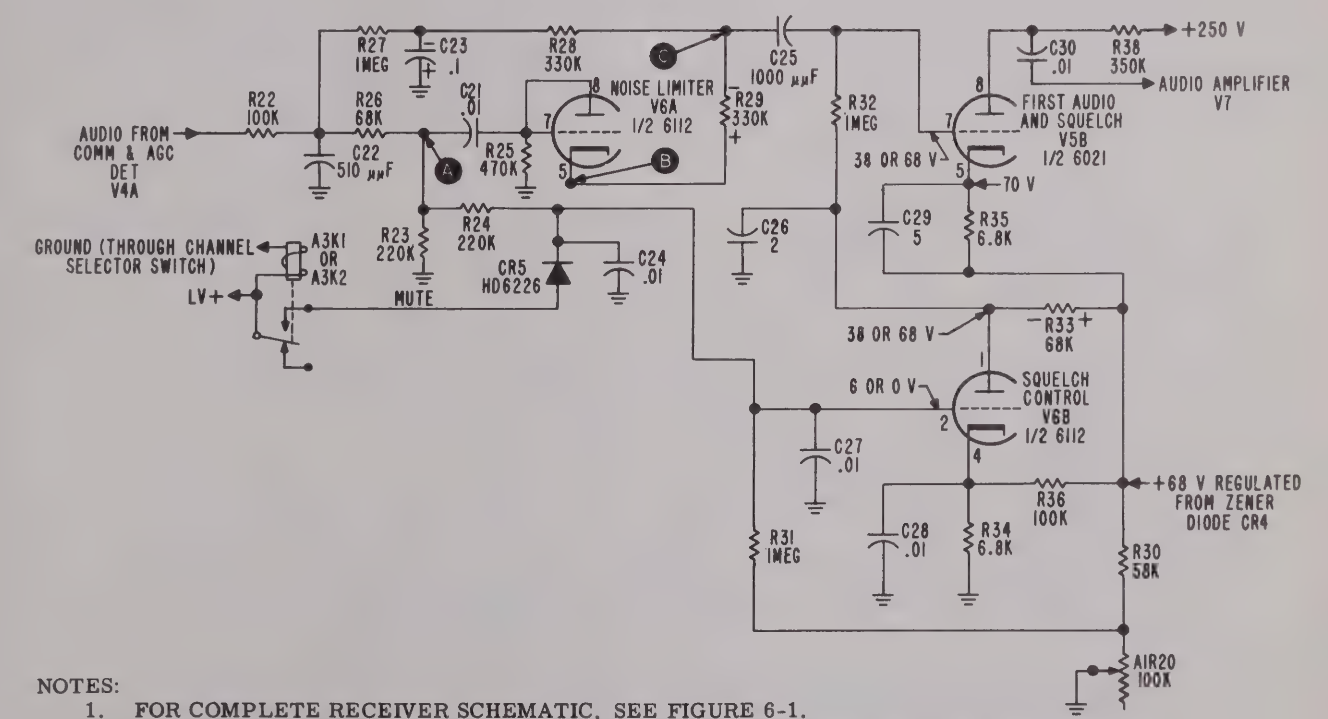
When V6B conducts, its plate voltage and the grid voltage of V5B are reduced to approximately 38 volts dc. The cathode of V5B has a potential of 70 volts dc which, when the grid voltage is reduced, serves to cut the tube off. When a carrier is present, a negative voltage is taken from across the detector load resistor, R23, and applied to the grid of the squelch control tube. This negative voltage cancels all or most of the positive 6 volts on the



NOTES:
1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. VALUE DETERMINED DURING FACTORY ALIGNMENT.
3. ALL PARTS ARE LOCATED ON I-F/A-F ASSEMBLY A2.
4. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF), UNLESS OTHERWISE NOTED.
5. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1, 000, 000.
6. CR1 IS USED ON 28-VOLT MODELS WITH SERIAL NO. 101—110, 112, 114, AND 117 ONLY.

TP1823

Figure 4–12. Detector and Agc Circuit, Schematic Diagram



NOTES:
1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. ALL PARTS ARE LOCATED ON I-F/A-F ASSEMBLY A2, UNLESS THE PART DESIGNATION IS PRECEDED BY AN ASSEMBLY DESIGNATION (A1 OR A3).
3. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
4. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1, 000, 000.

TP1825

Figure 4–13. Noise Limiter, First Audio and Squelch, and Squelch Control and Muting Circuits, Schematic Diagram

grid of V6B, and conduction in the tube is decreased. With reduced current flow through V6B, the d-c potential on the grid of V5B increases to approximately 68 volts, and V5B conducts and amplifies the detected audio.

Front-panel squelch control A1R20 is used to adjust the threshold level of the squelch circuit by controlling the level of the positive d-c voltage applied to the grid of the squelch control tube. A muting circuit, controlled by tuner assembly relay A3K1 or A3K2, applies LV+ to the control grid of V6B during receiver channeling to silence the unit.

FIRST AUDIO AMPLIFIER AND AUDIO OUTPUT STAGES. The first audio amplifier, V5B, uses one-half of a 6021 twin triode (see Figure 4–14). Its grid bias is controlled by the squelch control tube, V6B. V5B operates as a voltage amplifier to supply the driving power for the audio output stage, V7.

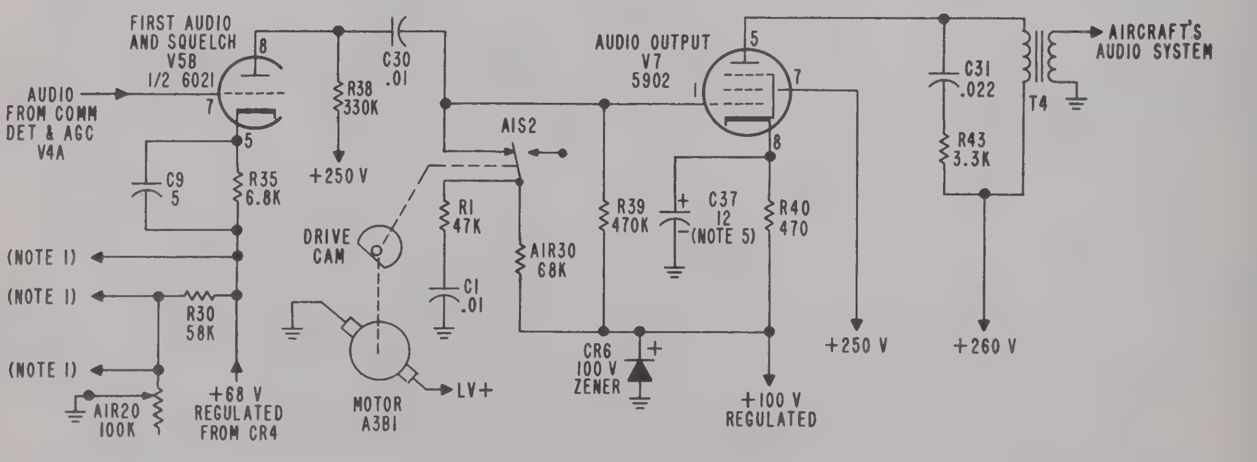
Tube V7, a 5902 beam-power pentode, provides audio power to the aircraft's audio distribution line. The gain of the tube is controlled automatically by switch A1S2. The switch is operated by the tuning assembly motor, A3B1. When the receiver is tuned to a channel in the high-level-modulation communication band (118.00–126.90 mc), a cam driven by motor A3B1 sets A1S2 to the position shown in Figure 4–14, connecting resistor A1R30 in parallel with R39. Paralleling R39 reduces the output of V7 to the level obtained from low-level-modulation navigation-band audio signals. Resistor R1 and capacitor C1, connected in series, are used to set the high-frequency rolloff point of the stage at approximately 2500 cps.

PRIMARY AND H-V POWER DISTRIBUTION. Primary power is applied through the rack to the receiver when the power switch on the control unit is turned on. The primary power is applied through choke A2L2 (see Figure 6–1) to the two ¾-ampere branches of the receiver heater circuit and through pin 2 of A2J3 to the Dynaverter. For 28-volt operation, the branches of the heater circuit are connected in series and the DV-10A Dynaverter is used. For 14-volt operation, the branches of the heater circuit are connected in parallel and the DV-11A Dynaverter is used.

High voltage is applied from the Dynaverter, through the wired plug which shorts pins A and E of A1J3, to the plate of the receiver audio output stage and to a Pi-type high-voltage filter in the receiver. The filter, consisting of A2C33, A2L1, and A2C35B, is used to remove ripple voltage from the Dynaverter output. The filtered output, now 250 volts dc, is applied to the 250-volt bus wire for distribution throughout the receiver and through pin 7 of A2J4 and the rack of the converter.

4–4. B-13A-1 CONVERTER.

General. The B-13A-1 Converter receives VOR information from the R-34A Receiver. The B-13A-1 is designed to convert and interpret the information in such a way that the bearing of the receiving antenna from the transmitting antenna may be determined. The converter is also designed to accept the localizer information from the receiver and convert it to a form that is presented visually through the vertical pointer of the IN-10.



NOTES:
1. FOR COMPLETE RECEIVER SCHEMATIC, SEE FIGURE 6-1.
2. ALL PARTS ARE LOCATED ON I-F/A-F ASSEMBLY A2, UNLESS THE PART DESIGNATION IS PRECEDED BY AN ASSEMBLY DESIGNATION (A1 OR A3).
3. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
4. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.
5. C37 IS NOT USED ON 28-VOLT MODELS WITH SERIAL NO. 117, 115 AND BELOW.

Figure 4–14. Audio Output Stage, Schematic Diagram

TP1827

VOR Circuits. The VOR navigational signal from the R-34A consists of two independent signals. One is 30 cps and is known as the "variable channel" signal. Its phase in space at any given instant is a function of the bearing from the transmitter. The other is 10 kc (actually 9960 cps) and is known as the "reference channel" signal. This signal is frequency-modulated at a 30-cps rate to 480 cps above and below 9960 cps. The phase of the reference channel is independent of the bearing from the transmitter. Omnidirectional range transmission is such that for a signal received directly north (magnetic) of the VOR station, the 30-cps variable channel amplitude modulation is in phase with the 30-cps frequency modulation of the 10-kc channel. When this signal is being received, the data presented by the IN-10 Course Indicator will be 0° TO or 180° FROM the station. (All bearings are *magnetic* in VOR.) At all points around the transmitter, the two 30-cps voltages differ in phase by an amount equal to the receiving antenna's bearing from the transmitter. The function of the VOR section of the converter, with the aid of the IN-10 Course Indicator, is to measure this phase difference, which is then read on the IN-10 as a bearing to or from the VOR station.

The 10-kc FM signal is diverted by filters into the reference channel consisting of V201A, V203A, V203B, V204A, V205A, V204B, and T201 (see Figure 4–15). The 30-cps AM signal is diverted by filters into the variable channel consisting of V205B, V201B, and T202. The secondary circuits of T201 and T202, with the IN-10, determine whether the two secondary voltages are 90° apart in phase and which phase is leading. The course selector portion of the IN-10 and its associated circuits can be used to shift the phase of the reference channel signal as desired until the vertical pointer indicates that the two phases are 90° apart. When this condition exists, the vertical pointer is centered.

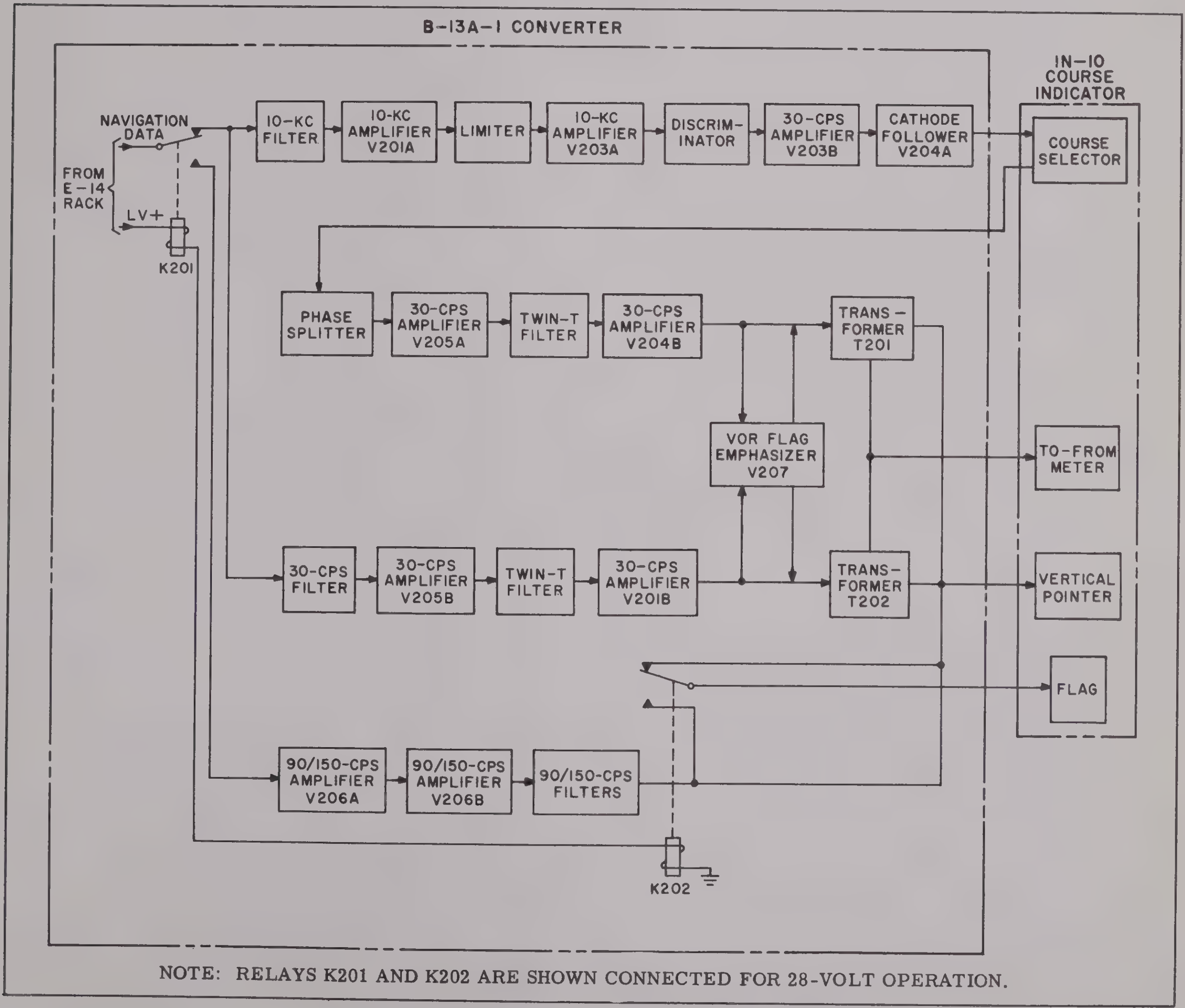


Figure 4–15. B-13A-1 Converter, Block Diagram

TP1829

Reference channel. The 10-kc FM signal from the R-34A Receiver is passed by a 10-kc high-pass filter to voltage amplifier V201A (see Figure 4–16). The output of V201A is fed to the limiter, which removes any AM that might be present on the 10-kc FM signal. Further amplification of the signal, which has been reduced to approximately one-third of its original amplitude, takes place in the second 10-kc amplifier, V203A. The output of V203A is applied to the discriminator where the 30-cps modulation is extracted from the FM signal. This modulation is applied through a 30-cps amplifier, V203B, and a cathode follower, V204A, to the course selector portion of the IN-10. The cathode follower matches the high output impedance of the 30-cps amplifier to the low impedance of the course selector. The unbypassed rotor of the course selector is in series with the cathode of V204A. Since the rotor is unbypassed, the plate current of the cathode follower produces a 30-cps alternating magnetic field around the rotor, which in turn induces a voltage in the stator windings.

The two stator windings of the course selector are displaced by 90°. Since the stators feed the RC circuit consisting of R221, R222, R223, and C210, and since the voltage of each stator varies sinusoidally as the rotor is revolved, the course selector in combination with the RC circuit forms a phase-splitting network. The value of R222 is selected at the time of final factory adjustment of the converter to minimize course deviation errors. Variable resistor R225 and capacitor C211 are used as a limited-range, adjustable, phase-shifting network. The output of the network is applied to the 30-cps amplifier, V205A. Variable resistor R226 in the cathode circuit of V205A is used to control the gain of the tube. The output of V205A is filtered by a 60-cps twin-**T** filter. The filter removes any propeller modulation that may be present on the reference channel signal, even though the amount of propeller modulation on this FM signal is slight. The output of the filter is amplified by another 30-cps amplifier, V204B, and fed to the primary of transformer T201. The primary of T201 is tuned to 30 cps by C220.

Variable channel. A-f navigation signals are applied from the R-34A to the converter's 30-cps low-pass filter as shown in Figure 4–17. The filter, consisting of R241, C221, R242, and C222, passes the 30-cps AM signal and suppresses voice and 10-kc FM signals. The output of the filter is amplified by a 30-cps amplifier, V205B, and applied through a 60-cps twin-**T** filter to a second 30-cps amplifier, V201B. The filter supresses 60-cps voltages and eliminates any propeller modulation that may have been introduced. The output of V201B is fed to transformer T202, the primary of which is tuned to 30 cps by C233.

Vertical pointer circuit. The vertical pointer circuit of the B-13A-1 Converter is essentially a wattmeter. No current flows through the pointer meter coil when the outputs of T201 and T202 are 90° apart in phase. If the phase relationship of the outputs is not 90°, the vertical pointer will swing left or right, indicating that the aircraft is off course.

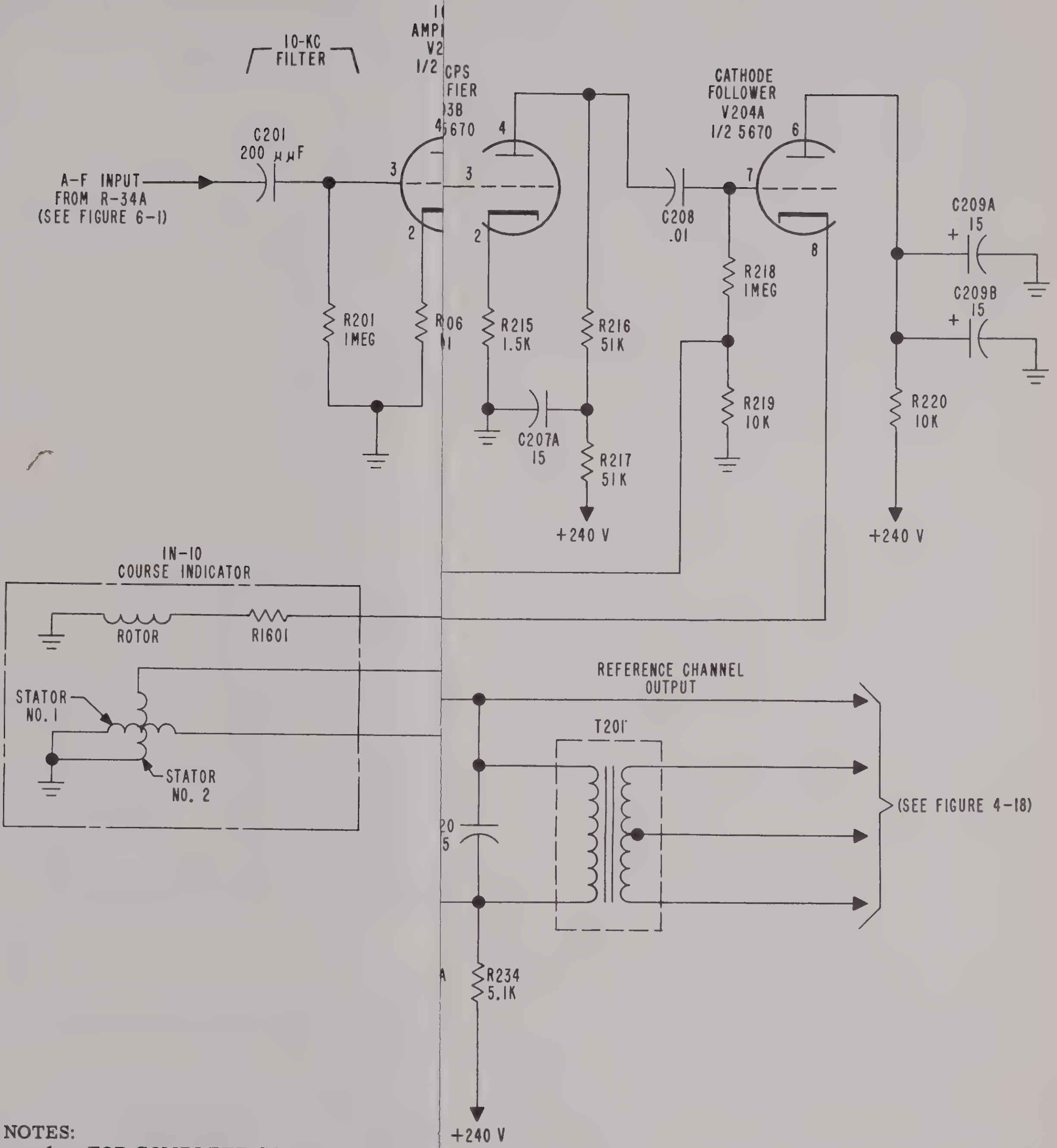
As shown in Figure 4–18, the wattmeter circuit consists of CR207, CR208, R238, R239, R240, and the vertical pointer meter coil. The purpose of R238 and R240, in series with CR207 and CR208, respectively, is to build out the forward resistance of these two crystals to a point where normal changes in the forward current resistance of the crystals are relatively unimportant. The purpose of the adjustable resistance, R239, is to permit the selection of the point of electrical balance between the crystals. It is necessary that this point be used; otherwise, the voltage from T201 alone would cause a deflection of the vertical pointer.

To-from circuit. The to-from meter circuit is similar to the wattmeter used to operate the vertical pointer circuit (see Figure 4–18). The to-from wattmeter circuit consists of CR205, CR206, R235, R236, and the coil of the indicator. The circuit is fed by output transformers T201 and T202, with the output of T202 shifted approximately 90° by R253 and C235. This additional phase shift resolves the ambiguity of the vertical pointer circuit by shifting the to-from meter output of T202 to put it approximately in phase with the output of T201 during an on-course TO indication and approximately 180° out of phase with the output of T201 for an on-course FROM indication. The 180° phase difference for TO and FROM signals causes a corresponding change in the direction of current flow through the meter coil. The direction of current flow in turn determines the direction of meter movement (TO or FROM).

Flag Control Circuits. The vertical pointer flag is used to indicate the presence or absence of usable output signals from the converter during both VOR and localizer operation. The flag is held out of sight by the effect of d-c current through its coil when the output of the circuits being used is reliable. When the output of the B-13A-1 becomes weak because of distance from the transmitting station, or is lost because of receiver, converter, or ground station malfunction, the current through the flag coil is reduced sufficiently to allow the flag to show.

Two controls, VOR FLAG and LOC FLAG, are provided for adjusting the sensitivity of the course indicator flag mechanism. The controls are adjusted for the required flag sensitivity during alignment of the B-13A-1.

Vor flag control. R268 (VOR FLAG) is used to adjust the sensitivity of the flag mechanism for VOR operation (see Figure 4–18). The control is connected in parallel with the flag coil of the indicating instrument and acts as a variable shunt across the coil. The sum of



NOTES:
1. FOR COMPLETE CONVERTER SCHE
2. VALUE SELECTED AT FACTORY TC
SIGNAL.
3. VALUE SELECTED AT FACTORY TC
ERROR.
4. CAPACITANCE VALUES ARE IN MIC
OTHERWISE NOTED.
5. RESISTANCE VALUES ARE IN OHMS;
MEG=1, 000, 000.

TP1831

Figure 4–16. Reference Channel Circuit, Schematic Diagram

Reference channel. The 10-kc FM signal from the R-34A Receiver is passed by a 10-kc high-pass filter to voltage amplifier V201A (see Figure 4–16). The output of V201A is fed to the limiter, which removes any AM that might be present on the 10-kc FM signal. Further amplification of the signal, which has been reduced to approximately one-third of its original amplitude, takes place in the second 10-kc amplifier, V203A. The output of V203A is applied to the discriminator where the 30-cps modulation is extracted from the FM signal. This modulation is applied through a 30-cps amplifier, V203B, and a cathode follower, V204A, to the course selector portion of the IN-10. The cathode follower matches the high output impedance of the 30-cps amplifier to the low impedance of the course selector. The unbypassed rotor of the course selector is in series with the cathode of V204A. Since the rotor is unbypassed, the plate current of the cathode follower produces a 30-cps alternating magnetic field around the rotor, which in turn induces a voltage in the stator windings.

The two stator windings of the course selector are displaced by 90°. Since the stators feed the RC circuit consisting of R221, R222, R223, and C210, and since the voltage of each stator varies sinusoidally as the rotor is revolved, the course selector in combination with the RC circuit forms a phase-splitting network. The value of R222 is selected at the time of final factory adjustment of the converter to minimize course deviation errors. Variable resistor R225 and capacitor C211 are used as a limited-range, adjustable, phase-shifting network. The output of the network is applied to the 30-cps amplifier, V205A. Variable resistor R226 in the cathode circuit of V205A is used to control the gain of the tube. The output of V205A is filtered by a 60-cps twin-**T** filter. The filter removes any propeller modulation that may be present on the reference channel signal, even though the amount of propeller modulation on this FM signal is slight. The output of the filter is amplified by another 30-cps amplifier, V204B, and fed to the primary of transformer T201. The primary of T201 is tuned to 30 cps by C220.

Variable channel. A-f navigation signals are applied from the R-34A to the converter's 30-cps low-pass filter as shown in Figure 4–17. The filter, consisting of R241, C221, R242, and C222, passes the 30-cps AM signal and suppresses voice and 10-kc FM signals. The output of the filter is amplified by a 30-cps amplifier, V205B, and applied through a 60-cps twin-**T** filter to a second 30-cps amplifier, V201B. The filter supresses 60-cps voltages and eliminates any propeller modulation that may have been introduced. The output of V201B is fed to transformer T202, the primary of which is tuned to 30 cps by C233.

Vertical pointer circuit. The vertical pointer circuit of the B-13A-1 Converter is essentially a wattmeter. No current flows through the pointer meter coil when the outputs of T201 and T202 are 90° apart in phase. If the phase relationship of the outputs is not 90°, the vertical pointer will swing left or right, indicating that the aircraft is off course.

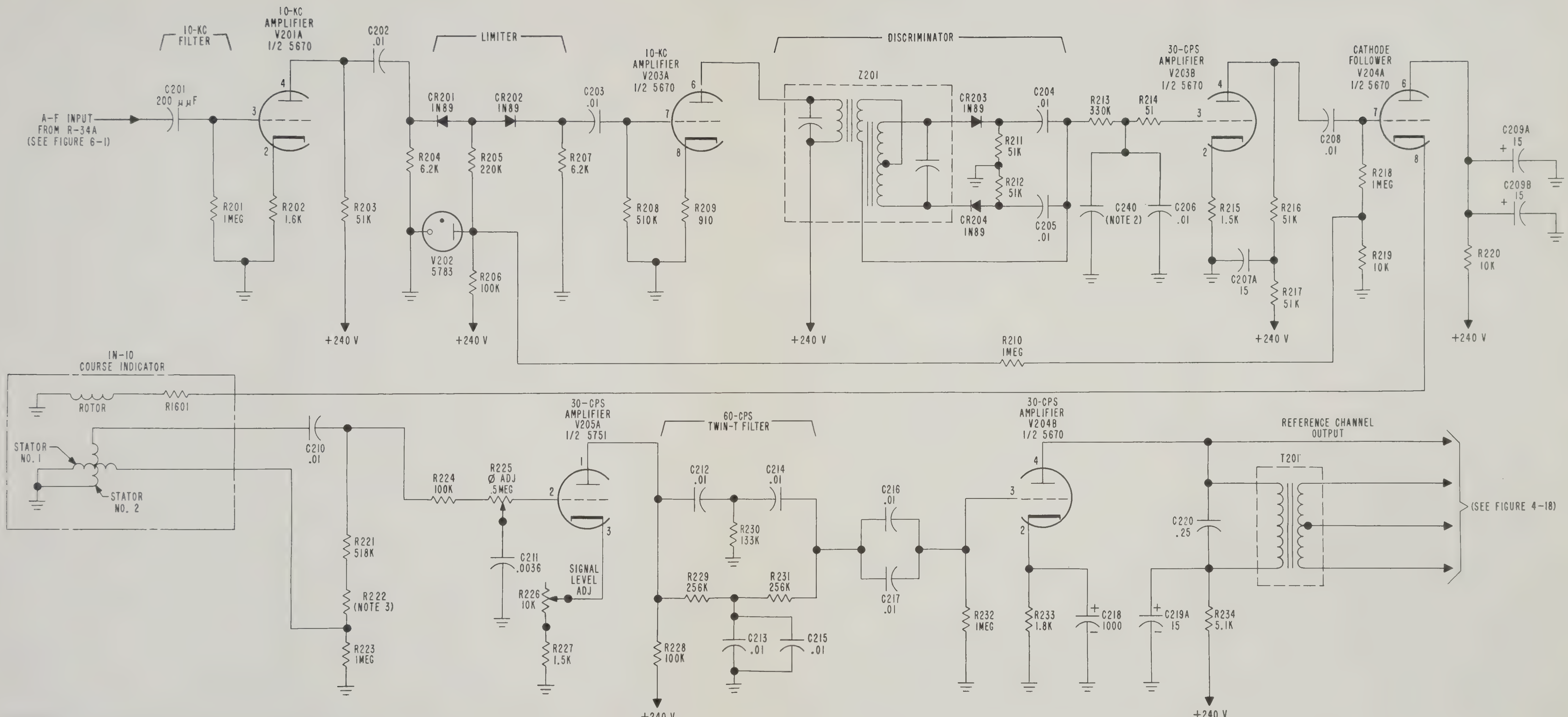
As shown in Figure 4–18, the wattmeter circuit consists of CR207, CR208, R238, R239, R240, and the vertical pointer meter coil. The purpose of R238 and R240, in series with CR207 and CR208, respectively, is to build out the forward resistance of these two crystals to a point where normal changes in the forward current resistance of the crystals are relatively unimportant. The purpose of the adjustable resistance, R239, is to permit the selection of the point of electrical balance between the crystals. It is necessary that this point be used; otherwise, the voltage from T201 alone would cause a deflection of the vertical pointer.

To-from circuit. The to-from meter circuit is similar to the wattmeter used to operate the vertical pointer circuit (see Figure 4–18). The to-from wattmeter circuit consists of CR205, CR206, R235, R236, and the coil of the indicator. The circuit is fed by output transformers T201 and T202, with the output of T202 shifted approximately 90° by R253 and C235. This additional phase shift resolves the ambiguity of the vertical pointer circuit by shifting the to-from meter output of T202 to put it approximately in phase with the output of T201 during an on-course TO indication and approximately 180° out of phase with the output of T201 for an on-course FROM indication. The 180° phase difference for TO and FROM signals causes a corresponding change in the direction of current flow through the meter coil. The direction of current flow in turn determines the direction of meter movement (TO or FROM).

Flag Control Circuits. The vertical pointer flag is used to indicate the presence or absence of usable output signals from the converter during both VOR and localizer operation. The flag is held out of sight by the effect of d-c current through its coil when the output of the circuits being used is reliable. When the output of the B-13A-1 becomes weak because of distance from the transmitting station, or is lost because of receiver, converter, or ground station malfunction, the current through the flag coil is reduced sufficiently to allow the flag to show.

Two controls, VOR FLAG and LOC FLAG, are provided for adjusting the sensitivity of the course indicator flag mechanism. The controls are adjusted for the required flag sensitivity during alignment of the B-13A-1.

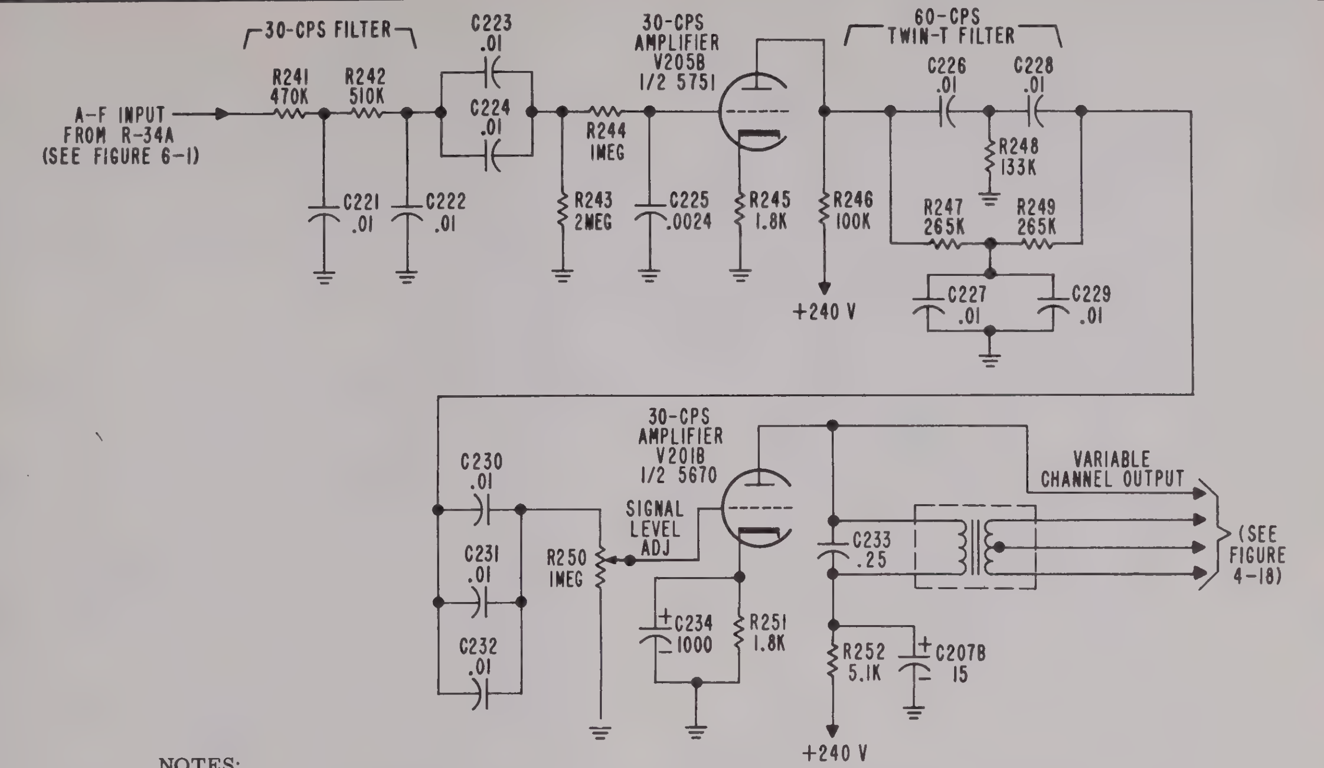
Vor flag control. R268 (VOR FLAG) is used to adjust the sensitivity of the flag mechanism for VOR operation (see Figure 4–18). The control is connected in parallel with the flag coil of the indicating instrument and acts as a variable shunt across the coil. The sum of



NOTES:
1. FOR COMPLETE CONVERTER SCHEMATIC, SEE FIGURE 6-12.
2. VALUE SELECTED AT FACTORY TO ADJUST PHASE OF SIGNAL.
3. VALUE SELECTED AT FACTORY TO MINIMIZE QUADRANTAL ERROR.
4. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
5. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1,000,000.

TP1831

Figure 4–16. Reference Channel Circuit, Schematic Diagram



NOTES:

1. FOR COMPLETE CONVERTER SCHEMATIC, SEE FIGURE 6-12.
2. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1,000,000.

TP1833

Figure 4–17. Variable Channel Circuit, Schematic Diagram

the outputs of reference channel transformer T201 and variable channel transformer T202 is applied to this parallel circuit, producing a current flow through it. Maximum flag sensitivity will result when R268 is set to the full clockwise position. R268 is factory-adjusted so that part of the flag shows when the level of both the reference and variable channel modulating signals is 15 per cent (½ standard value). Resistor R237, in series with R268 and the coil of the flag, is used as a current-limiting device.

Loc flag control. R269 (LOC FLAG) is used to adjust the sensitivity of the flag mechanism for localizer operation (see Figure 4–19). The control is connected in parallel with the flag coil of the indicating instrument and acts as a variable shunt across the coil. The sum of the output voltages of filters Z202 and Z203, applied to this parallel circuit, produces a current flow through the flag coil and R269. Maximum flag sensitivity will result when R269 is set to the full clockwise position (minimum shunting). R269 is factory-adjusted so that the flag shows when the level of one modulating signal (90 cps or 150 cps) is zero and the level of the other is standard (20 per cent). Crystal diode CR211 is placed in series with the flag coil to produce a nonlinear flag response, thereby insuring a full flag indication with the loss of one modulation.

Vor flag emphasizer. The VOR flag-emphasizer circuit (see Figure 4–18) is designed to insure a definite flag indication when either the reference phase or variable phase signal is unreliable. This cricuit consists of a twin triode used essentially as two switches, the sections of which are cross-connected between the reference channel and variable channel output circuits. In normal operation, the variable channel signal at the plate of V201B is rectified by CR212, and the resultant d-c voltage (−25 volts) is applied to the grid of V207A to hold the tube at cutoff. At cutoff the plate impedance is essentially infinite and hence does not shunt the output of V204B. If the variable signal output drops below a usable level, the cutoff bias will not be applied to the grid of V207A and the tube will conduct. This conduction produces a low plate impedance, which heavily shunts the output of V204B. This shunting loads the output of the reference channel, attenuating it sufficiently to make the reference channel as well as the variable channel very low in output, thereby providing a definite flag indication.

By similarly connecting V207B across the output of the variable channel, and controlling its operation in the same manner as described for V207A, an unreliable reference channel signal will cause attenuation of the variable channel output and a definite flag showing.

Localizer Circuits. The localizer circuits of the converter consist of two resistance-coupled amplifiers designed to accept localizer information delivered by the receiver and convert it for visual presentation through the vertical pointer of the IN-10. When the receiver is tuned to a localizer frequency, receiver switch A1S1 is actuated and LV+ is applied to converter relays K201 and K202. When energized, K201 connects the 240-volt dc line to the plate circuits of the 90/150-cps amplifiers and the navigational audio output of the R-34A to the grid of V206A. Energizing relay K202 connects the IN-10 flag circuit to the output of the localizer circuit. The two triode sections of V206 constitute a conventional two-stage amplifier whose output is fed to a 90-cps and a 150-cps filter in parallel (see Figure 4–19). The 90-cps component of the input signal is selected by the 90-cps filter, Z202. The 150-cps component is selected by Z203. The outputs of Z202 and Z203 are used in a balanced circuit. When they are equal, no voltage is produced across the vertical pointer meter movement and an on-course indication is produced.

4–5. DV-10A AND DV-11A DYNAVERTERS.

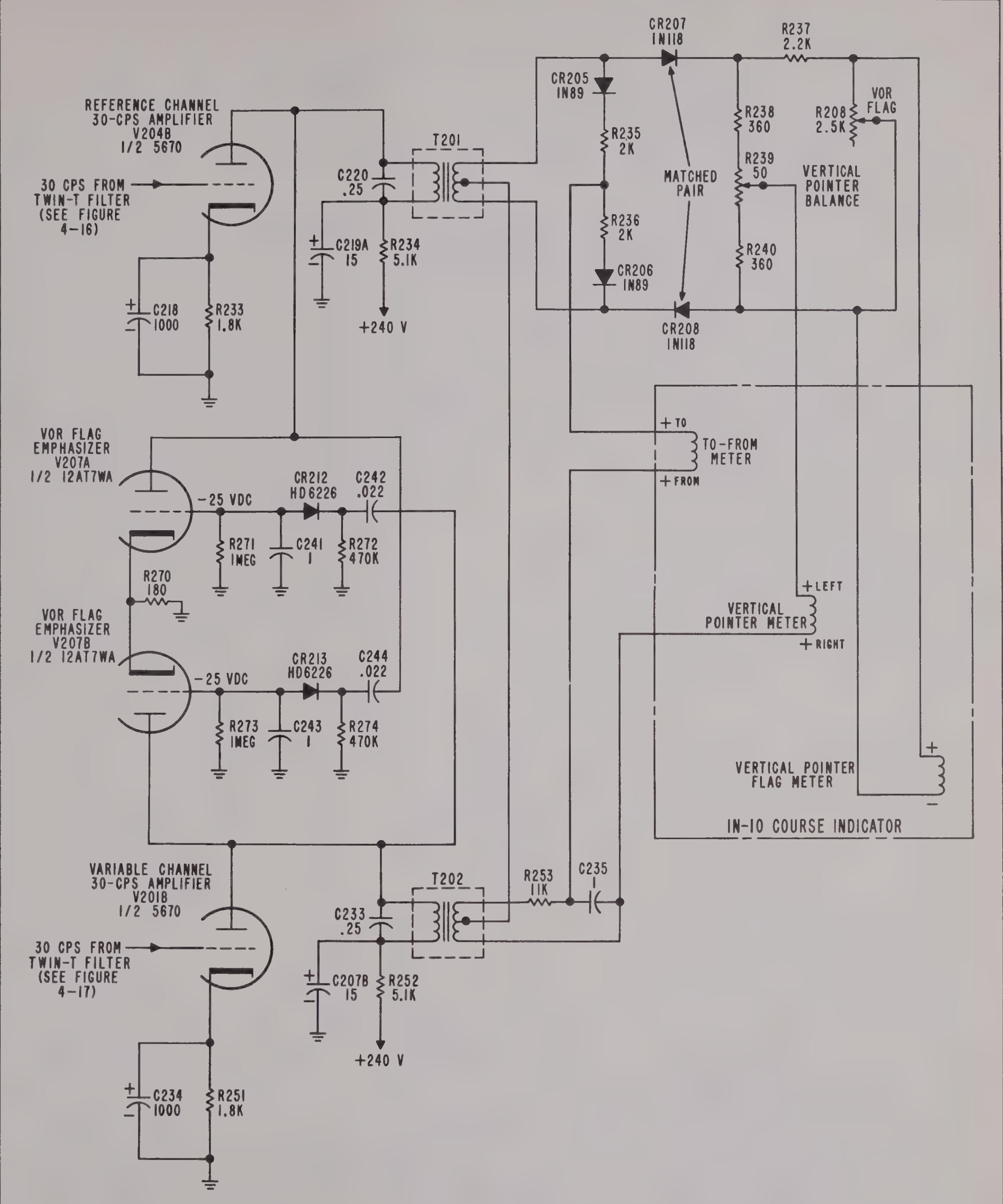
The ARC Type DV-10A and DV-11A Dynaverters (see Figures 6–22 and 6–24) are transistorized high-voltage power supplies. Low-voltage dc from a primary source is applied to two high-power transistors connected in a self-excited multivibrator switching circuit. This circuit furnishes reversing-polarity, square-wave pulses to the primary winding of a specially designed transformer. The secondary winding of the transformer provides a square-wave alternating current that is rectified and filtered to provide a d-c output at the desired voltage. The magnitude of this voltage depends on the primary-secondary turns ratio of the transformer. The transformer also has two feedback windings that control the switching action of the transistors.

4–6. CONTROL UNITS.

The C-81A Control Unit includes a volume control combined with a power on-off switch (VOL-OFF), a megacycle channel selector switch, a fractional megacycle channel selector switch, and a squelch threshold-level control (SQUELCH). As shown in Figure 4–3, initial rotation of the VOL-OFF control will close rotary switch S3 and apply primary power to relay K301 in the E-14 Rack. K301, in turn, applies primary power to the equipment. The volume control, R1, is connected as a variable shunt resistor across the output of the receiver audio output stage, V7.

The megacycle channel selector switch, S1A, is a twenty-position, printed-circuit switch assembly (see Figure 6–14) which selects one of 19 crystals or the blank space (20 crystals may be used) on the megacycle crystal drum. The fractional megacycle channel selector switch, S1B, is a twenty-position, printed-circuit switch assembly used to select one of 10 crystals on the fractional megacycle crystal drum. The binary code used to meet these switching requirements employs five control wires per crystal drum. The wire switching code is shown in simplified schematic form in Figure 4–6. The method of channel selection is described in paragraph 4–3 and illustrated in Figure 4–5. Switches S1A and S1B are also used to control the operation of the R-34A automatic VOR-localizer and audio-equalizing switching circuits (refer to paragraph 4–2).

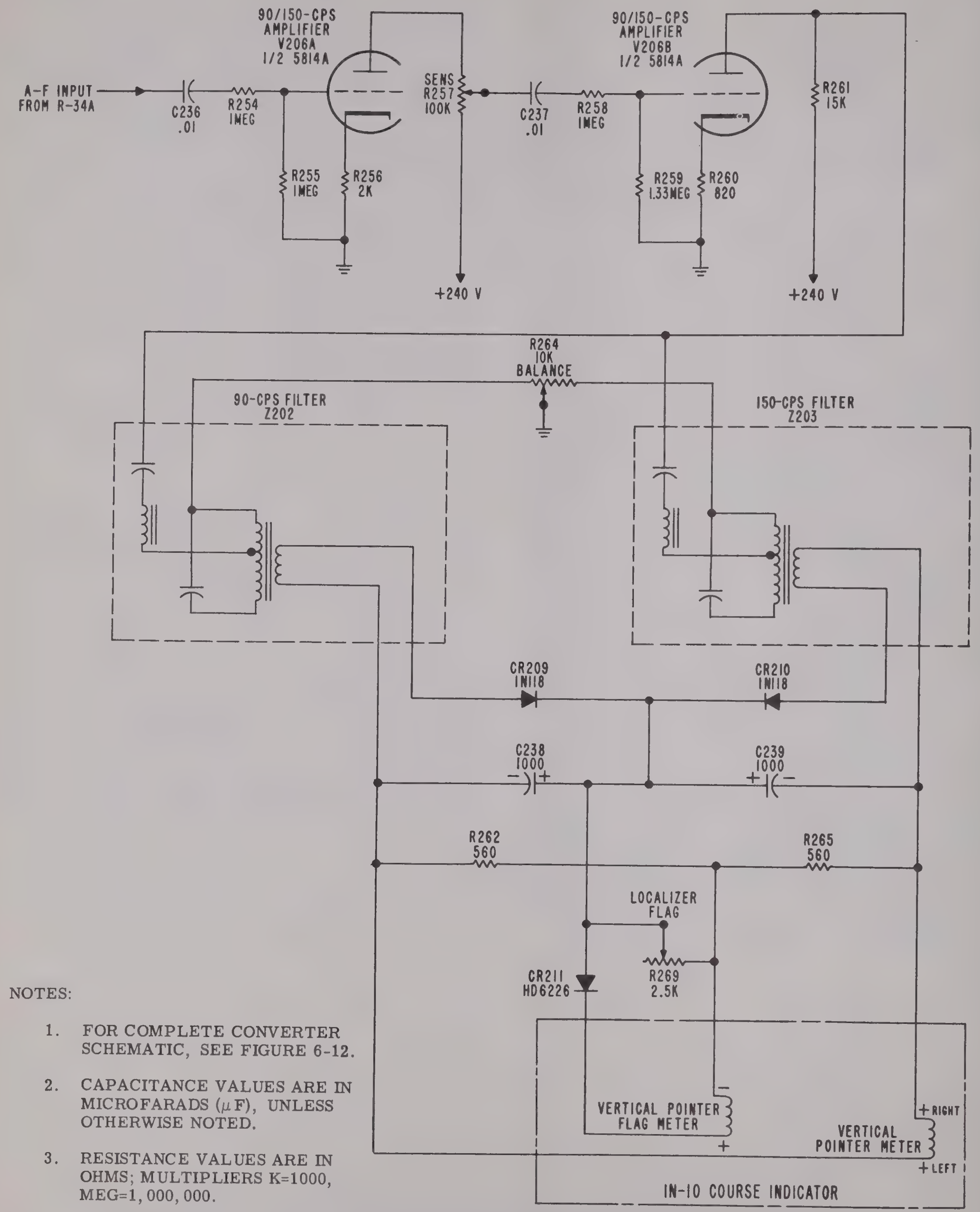
The C-88A Control Unit (see Figure 6–16) performs all of the C-81A functions. In addition, the C-88A automatically tunes the ARC Type R-31A Glide Slope Receiver to the correct glide slope frequency when the R-34A Receiver is tuned to a localizer frequency. The CC-11A and CC-12A Custom Control Units (see Figures 6–18 and 6–20) perform the channel selection functions of the C-81A and the C-88A, respectively. The custom control units do not contain the SQUELCH and OFF-VOL controls found on the C-81A and C-88A; these controls are installed separately in custom installations.



NOTES:
1. FOR COMPLETE CONVERTER SCHEMATIC, SEE FIGURE 6-12.
2. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1,000,000.

TP1835

Figure 4–18. To-From, Vertical Pointer, Flag Emphasizer, and Flag Circuits, Schematic Diagram



NOTES:

1. FOR COMPLETE CONVERTER SCHEMATIC, SEE FIGURE 6-12.
2. CAPACITANCE VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE NOTED.
3. RESISTANCE VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1, 000, 000.

Figure 4–19. Localizer Circuit, Schematic Diagram

TP1837

SECTION V
MAINTENANCE

5–1. INTRODUCTION.

This section contains test equipment data, preventive maintenance information, removal and replacement procedures, trouble analysis information, and alignment and adjustment procedures for the ARC Type 15F Equipment. Interior views are included to help service personnel locate and identify individual assemblies, subassemblies, and detail parts of the Type 15F units. Schematic and wiring diagrams are included in Section VI.

WARNING

Voltages used in this equipment may prove fatal if contacted. Observe all safety precautions.

5–2. TEST EQUIPMENT.

Table 5–1 lists the test equipment required for maintenance of the Type 15F; equivalent test equipment may be substituted. Use of the ARC Type BTK-15F Bench Test Kit is recommended to facilitate maintenance procedures. The BTK-15F includes all necessary interconnecting cable assemblies for test and alignment procedures and a cycling test box for checking the operation of the receiver tuning circuits.

5–3. PREVENTIVE MAINTENANCE.

General. Experience has proved that the frequency of equipment failures is reduced when periodic preventive maintenance inspections are made. The inspections will frequently uncover defective parts before complete breakdown occurs, and may therefore enable service or operating personnel to take corrective action before

TABLE 5–1. TEST EQUIPMENT

Qty	Name	Designation	Characteristics
1	Attenuator	Boonton Radio Type 505-B	500 ohms, 6 db
1	Audio Oscillator	Hewlett-Packard Model 200AB	—
1	Bench Test Kit	ARC Type BTK-15F	—
1	Electronic Switch	DuMont Type 330	—
1	Headset	ARC-11935	—
1	Low-voltage Supply	—	14- or 28-volt storage battery or rectified d-c supply
1	Milliammeter	—	0-1 ma, 1000-ohm dc resistance (tuning meter)
1	Microammeter	—	200-0-200 μa, 1000-ohm dc resistance
1	Multimeter	Simpson Model 260	20,000 ohms/volt
1	Oscilloscope	DuMont Type 340	—
1	Signal Generator	ARC Type H-14A	Supplied with 110.8-, 110.9-, and 114.9-mc crystals
1	Signal Generator	Boonton Radio Type 211-A	108–126.9 mc
1	Signal Generator	Measurements Corp. Model 65-B	1.7 and 11.7–12.6 mc
1	Spline Wrench	Bristol No. 4	—
1	Tube Tester	Weston Model 798	—
1	Tuning Wand	—	Teflon wand equipped with iron and brass tips
1	Vacuum Tube Voltmeter	Ballantine Model 300	—
1	Vacuum Tube Voltmeter	Hewlett-Packard Model 410B	—
1	VHF Navigation Receiving Equipment	ARC Type 15F VHF Navigation Equipment	For substitution and over-all tests

the over-all operation of the equipment is affected. Table 5–2 lists the recommended preventive maintenance inspections for Type 15F units. The inspections listed should be performed at regularly established periods. The interval between inspections should be determined after considering the amount of use given the aircraft and the Type 15F, and the climatic conditions under which the equipment is used and stored.

TABLE 5–2. PREVENTIVE MAINTENANCE

Part	Procedure
	ANTENNA
Antenna Unit	Inspect for deterioration and cracks in rubber block. Inspect dipoles for looseness, bends, cracks, and corrosion. Tighten mounting screws. Clean rubber block with warm water and mild soap. If dipoles are oxidized, clean with cleaning solvent. **Caution** Do not use cleaning solvent on rubber block.
Antenna Pedestal	Inspect for cracks and warping. Tighten mounting screws. Clean with soap and water, or cleaning solvent.
Base Plate	Clean. Inspect for cracks and warping. Tighten mounting screws.
Connectors	Clean and tighten.
Coaxial Cable	Inspect for deterioration, torn or cracked insulation, and loose connectors.
	CONTROL UNIT
Control Knobs	Tighten setscrews. Check for normal operation. Touch up chipped paint with black, lusterless paint.
Panel Light Assemblies	Unscrew light caps. Check lamps for defective filaments and inspect for worn base contacts. Clean red filters. Inspect rubber grommets for deterioration. Inspect light caps for cracks and chipped paint. Reassemble lights and test for normal operation. Touch up chipped paint with black, lusterless paint.
Plastic Panel	Clean with a dry, lintless cloth. Tighten mounting screws. Touch up chipped paint with black, lusterless paint.
Wiring	Inspect for loose or corroded connections and stripped or broken insulation.
Channel Selector Switch Assembly	Lubricate as shown in Figure 5–2. Inspect for loose terminals. Use an ohmmeter to check each switch position for positive action (see Figure 6–14 for switching code).
Variable Resistors and Power Switch (C-81A and C-88A only)	Use an ohmmeter to check for smooth operation from 0 to 5000 ohms (VOL) and from 0 to 100,000 ohms (SQUELCH). Check power switch for positive action.
Connectors	Inspect for loose ring nuts and dirty, loose, or broken terminals. Tighten external cable connectors.
Cover	Check condition of Dzus fastener screws. Replace cover and check locking action.
	CONVERTER
Exterior	Clean. Inspect threaded inserts on bottom plate for looseness and stripped threads. Inspect connectors and test jacks for looseness, cracks, and corrosion. Inspect snapslide studs, front panel conical studs, and adjustment control locknuts for looseness. **Caution** Do not change settings of adjustment controls when tightening locknuts.
Electron Tubes and Tube Sockets	Remove dust. Inspect tubes for cracked envelopes and bent or corroded pins. Inspect sockets for cracks, looseness, and corroded or dirty pin connectors.
Relays	Clean with a soft, dry brush or low-pressure (10 psi) compressed air. Inspect for burned, pitted, or corroded contacts (if necessary, clean with crocus cloth). Check contacts for improper alignment and insufficient spring tension. Inspect wires for loose connections and stripped or cracked insulation. Inspect coils for signs of overheating. Tighten mounting screws.
Terminal Boards	Clean with a soft, dry brush or low-pressure (10 psi) compressed air. Inspect for cracks. Tighten mounting screws.
Wiring	Inspect for loose or corroded connections, stripped or broken insulation, and split tubing.
Resistors, Capacitors, Diodes, Coils, etc.	Inspect for signs of overheating. Tighten loose mounting hardware (when applicable). Clean with low-pressure (10 psi) compressed air.

TABLE 5–2. PREVENTIVE MAINTENANCE — Continued

Part	Procedure
	COURSE INDICATOR
Exterior	Clean meter glass. Check course selector knob and pointer for binding or slippage. Inspect connector for loose, dirty, broken, or bent terminals. Tighten cable connector.
	DYNAVERTER
Exterior	Clean. Inspect connector for cracks, corroded contacts, and broken wires. Inspect snapslide fasteners for looseness and bent channels. Touch up chipped paint with black, lusterless paint. Safety-wire snapslide fasteners.
Interior	Inspect for signs of overheating, loose or dirty connections, broken or damaged wires, and loose mounting hardware.
	MOUNTING
Vibration Mounts	Inspect rubber shock absorbers for grease, deterioration, and excessive looseness.
Ground Straps	Tighten mounting screws. Inspect for kinks.
Frame	Clean. Tighten mounting hardware.
	RACK
Exterior	Clean. Inspect snapslide fasteners for looseness and bent channels. Inspect nut-and-link fasteners for dirt, loose mounting, and bends. Tighten screws on junction box. Inspect channel frames for broken rivets. Safety-wire snapslide fasteners. Touch up chipped paint.
Relay	Clean with a soft, dry brush or low-pressure (10 psi) compressed air. Inspect for burned, pitted, or corroded contacts (if necessary, clean with crocus cloth). Check contacts for improper alignment and insufficient spring tension. Inspect wires for loose or corroded connections and stripped or cracked insulation. Inspect coils for signs of overheating. Tighten mounting screws.
Capacitors	Inspect for signs of overheating, loose or dirty connectors, and loose mounting screws.
Connectors	Tighten ring nuts. Inspect for bent, broken, or corroded terminals.
Wiring	Inspect for loose or corroded connections and cracked or stripped insulation.
	RECEIVER
Exterior	Clean. Inspect threaded inserts on bottom plate for looseness and stripped threads. Inspect connectors for looseness, broken pins, and corrosion. Inspect Dynaverter mounts for excessive looseness and deterioration of rubber shock absorbers. Tighten front panel conical studs and adjustment control locknut. **Caution** Do not change setting of adjustment control when tightening locknut.
Electron Tubes	Remove dust. Inspect for cracked envelopes, broken leads, and loose connections.
Mechanical Gearing and Switching Assemblies	Inspect for binding or slippage. Lubricate as shown in Figure 5–1. Inspect for broken gear teeth and improperly seated parts.
Crystals	Inspect holder for dirt, improper seating of crystals, and looseness.
Terminal and Printed-circuit Boards	Inspect for cracks, loose mounting screws, and dirt. Clean with low-pressure (10 psi) compressed air.
Relays	Clean with a soft, dry brush or low-pressure (10 psi) compressed air. Inspect for burned, pitted, or corroded contacts (if necessary, clean with crocus cloth). Check contacts for improper alignment and insufficient spring tension. Inspect wires for loose connections and stripped or cracked insulation. Inspect coils for signs of overheating. Tighten mounting screws.
Wiring	Inspect for loose or corroded connections, stripped or broken insulation, and split tubing.
Variable Capacitors and Air-core Coils	Clean with low-pressure (10 psi) compressed air. **Caution** Do not move capacitor plates or coil windings.
Resistors, Capacitors, Diodes, Coils, Transformers, etc.	Inspect for signs of overheating, loose or corroded connections, and loose mounting hardware (when applicable). Clean with low-pressure (10 psi) compressed air.

Reforming Electrolytic Capacitors. Whenever the E-14, E-15, and E-16 Racks are repaired or, in any case, every two years, the 1000-μf electrolytic capacitors should be reformed at their rated voltage. To reform these capacitors, proceed as follows:

Step 1. Disconnect all interconnecting cables. Remove the R-34A Receiver and B-13A-1 Converter from the rack(s).

Step 2. Remove the rear cover of the rack. In the E-16, unsolder one end only of R1701 and R1702. In the E-14, unsolder one end only of R301, R302, R303, and R304. In the E-15, no unsoldering is required.

Step 3. Connect a battery having the rated voltage $\pm 10\%$ of the capacitor working voltage through a current limiting resistor of approximately 22 ohms. With the battery negative connected to the negative terminal of the capacitor (not ground), apply the battery voltage across each capacitor for a period of at least 10 minutes.

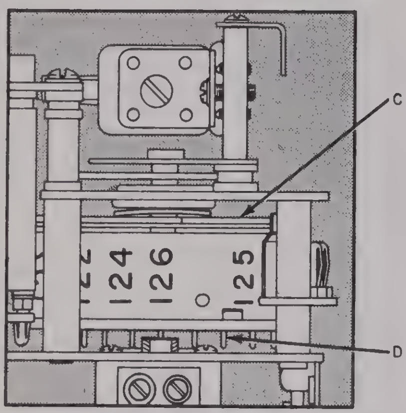
Step 4. After reforming the capacitors, discharge each capacitor by shorting it for a few minutes before resoldering the connections.

Caution

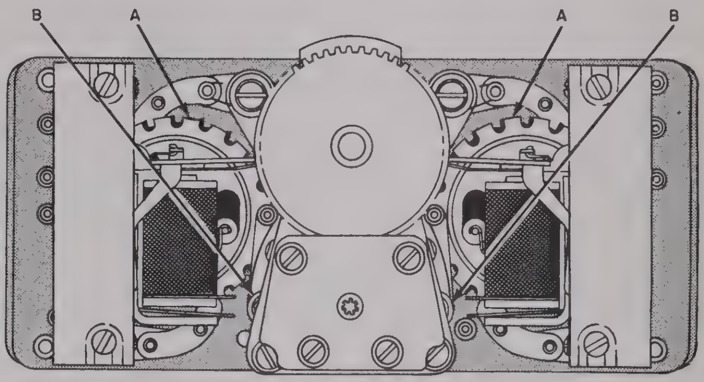
If the capacitors are not discharged before the B-13A-1 is reinstalled, the IN-10 Course Indicator may be damaged due to the capacitors discharging through it.

Step 5. Reconnect the resistors. Replace the back cover of the rack. Reconnect all cabling.

Lubrication. Figures 5–1 and 5–2 show the lubrication points for the R-34A Receiver and C-81A Control Unit, respectively. Remove old grease and oil before applying new lubricant to either unit.



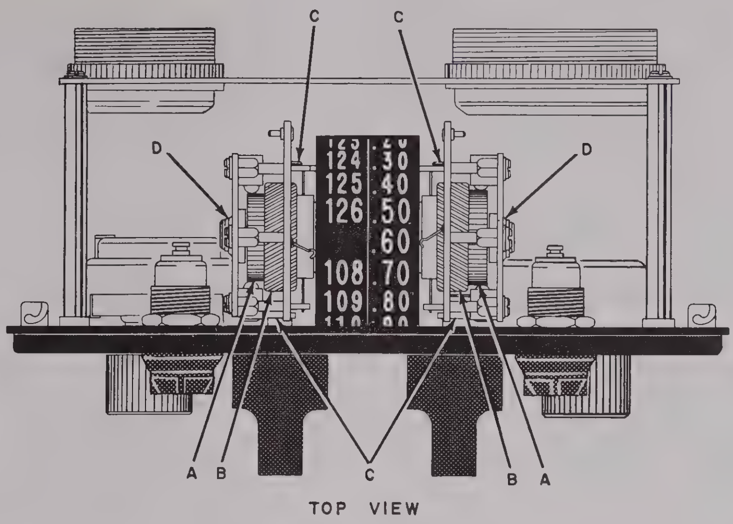
TYPICAL DRUM ASSEMBLY
SIDE VIEW



TUNER ASSEMBLY
TOP VIEW

Point of Lubrication	Part to be Lubricated	Lubrication Period	Kind of Lubricant	Method of Application
A	Indexing Plate Notches and Ratchet Teeth	500 hours	Aeroshell No. 7 Grease	Use a sharp-pointed tool to apply small amount to several notches and teeth.
B	Lever Arm Post Bearing	500 hours	Aeroshell No. 7 Grease	Use a sharp-pointed tool to apply a small amount.
C	Switch Plate Contact Surface	500 hours	Dow-Corning 510 Silicone Fluid	Apply small amount to several points on the contact surface of each switch plate with artist's brush.
D	Crystal Pins	500 hours	Dow-Corning 510 Silicone Fluid	Apply small amount to pins of several crystals in each drum with artist's brush.

Figure 5–1. R-34A Receiver, Lubrication Points TP1635



Caution

Keep oil and grease away from spring contacts and printed circuit contact plates, otherwise intermittent contact may result.

Point of Lubrication	Part to be Lubricated	Lubrication Period	Kind of Lubricant	Method of Application
A	Detent Gear	500 hours	Aeroshell No. 7 Grease	Apply thin coat to gear teeth with artist's brush.
B	Bevel Gear	500 hours	Aeroshell No. 7 Grease	Apply thin coat to gear teeth with artist's brush.
C	Control Shaft Bearing	500 hours	Pioneer No. 10 Oil	Invert unit and apply one drop to each bearing with a sharp-pointed tool.
D	Drum Shaft Bearing	500 hours	Pioneer No. 10 Oil	Apply one drop to each bearing.

TP1637

Figure 5–2. C-81A Control Unit, Lubrication Points

5–4. REMOVAL AND REPLACEMENT.

General. Except for the R-34A Receiver and the DV-10A or DV-11A Dynaverter, all parts of the Type 15F units can be replaced without major disassembly. Figures 5–3 through 5–23 are included as an aid in locating the parts by their schematic reference designations.

Replacement of Electron Tubes. The R-34A Receiver and the B-13A-1 Converter are the only units of the Type 15F that contain electron tubes. Tube locations are shown in Figures 5–3 and 5–18.

All tubes in the receiver are subminiature types and are accessible after the removal of the dust cover and the side and bottom plates. The tubes have flexible leads soldered directly to terminal points. When replacing a tube, the new tube leads should be oriented as nearly like the original installation as possible and the spacing between leads should be kept to a minimum of 1/16 inch. Do not precut the tube leads before installation. Use a minimum amount of solder during installation.

Caution

The receiver may require realignment if tube A1V1, A1V2, A1V6, or A2V4 is replaced (refer to paragraph 5–7).

The converter contains six 9-pin miniature tubes, which are accessible after the top cover is removed. Be careful when removing or replacing the tubes to prevent bending of the tube pins. If tubes are removed for testing, return those that test "good" to the same socket from which they were removed.

Replacement of Semiconductors. The receiver, converter, and Dynaverter contain semiconductor diodes. Diode locations are shown in Figures 5–3, 5–19, 5–21, 5–22, and 5–23. Whenever a diode is replaced, it must be oriented correctly. When soldering, hold the lead with pliers between the semiconductor body and the soldering point to form a heat sink and prevent excessive heat from damaging the diode. Do not remove the pliers until the heat from the solder joint has been dissipated.

Removal of Receiver Dust Cover and Bottom Plate.

Step 1. Release the four snapslide fasteners on the Dynaverter, and carefully lift the Dynaverter off the R-34A chassis.

Step 2. Remove the two black oxidized screws from each side of the dust cover. Slide the cover back to clear the front panel, then lift it up and off.

Step 3. Remove the eight black oxidized screws holding the bottom plate to the chassis. Lift the plate clear.

Separation of R-f/I-f and I-f/A-f Assemblies.

Step 1. Remove the Dynaverter, dust cover, and bottom plate from the receiver as previously described.

Step 2. Disconnect the 21-pin connector and the adjacent coaxial cable connector from the i-f/a-f chassis (A2).

Step 3. Remove the three black oxidized screws used to attach assembly A2 to the back and right side of assembly A1. Note that the screw removed from the right side is longer than the other two screws.

Step 4. Unscrew the two black oxidized screws from the top bearing plate and the two black oxidized screws from the main center plate to release the front panel and assembly A1 from assembly A2.

Step 5. Pull assembly A2 straight back to remove it from the rest of the receiver.

Step 6. For access to parts in assembly A1, remove the side plate by unscrewing the 11 attaching screws.

Replacement of I-f/A-f Assembly Printed Circuit Parts. Most of the parts used in the i-f/a-f assembly circuits are mounted on two printed-circuit boards. Parts on the small board are made accessible by removing two screws at each end of the capacitor mounting bracket (see Figure 5–9), unsoldering the ground wire from A2C8, and pushing the mounting bracket up. Parts on the large board are accessible after the i-f/a-f assembly is separated from the r-f/i-f assembly.

Be careful when removing a part from either printed-circuit board. The leads of the part being replaced should be cut close to the board and then pulled out of the opposite side after the solder is melted. An attempt to pull the part out by its body may damage the board because of the crimped leads on the parts. A light pencil iron should be held in contact with the lead until the solder melts.

Note

Do not apply heat longer than necessary, and remove the cut lead as quickly as possible. After parts are replaced and the board has cooled, Dow-Corning 991 Silicone Varnish should be brushed over the joint to make the surface moisture-repellent.

Replacement of Zener Diodes. The i-f/a-f assembly must be separated from the r-f/i-f assembly (as described previously) before Zener diodes A2CR4 and A2CR6 can be replaced. To replace diode A2CR4, proceed as follows:

Step 1. Unsolder the bus wire from the positive terminal of the diode.

Step 2. Remove the two screws holding the heat-sink block and remove the diode by unscrewing it from the block.

Step 3. When installing the new diode, screw it firmly into the heat-sink block, place the block in position, tighten the two screws, and resolder the bus wire to the positive terminal of the diode.

To replace A2CR6, proceed as follows:

Step 1. Unsolder the two violet wires from the positive terminal of A2CR6.

Step 2. Hold the hexagonal shoulder of the diode body with pliers to prevent it from turning, remove the nut and washers, and remove the diode.

Step 3. When installing the new diode, place the large solder lug under the diode, replace the flat washer and lockwasher on the stud, and tighten the nut, holding the hexagonal shoulder to prevent turning.

Step 4. Resolder the two violet wires.

Separation of Tuner Assembly from R-f/I-f Assembly.

Step 1. Separate the r-f/i-f and i-f/a-f assemblies as previously described.

Step 2. Loosen the two captive screws holding the gearing assembly (see Figure 5–4) to the tuner assembly.

Step 3. Remove the gearing assembly by lifting off the tuner assembly. Remove the stud and spring washer located on the left side of the tuner assembly mounting plate.

Step 4. Loosen the captive screw in each corner of the tuner assembly.

Step 5. Carefully lift the tuner assembly away from the main center plate of the r-f/i-f assembly until it clears the three mounting posts. Disconnect plugs P2, P3, and P4 from the tuner and lay the tuner aside.

Replacement of Crystals.

Step 1. Separate the tuner assembly from the r-f/i-f assembly as previously described.

Step 2. Remove the crystal clamping plate from the appropriate crystal drum assembly by removing the four screws which attach the plate to the drum (see Figure 5–17).

Step 3. Using tweezers or small, long nose pliers, remove the desired crystal.

Step 4. Check the replacement crystal for correct frequency and straight pins. Install the replacement crystal.

Step 5. Place the crystal clamping plate in position over the crystals. Check each crystal for correct position under its segment of the plate.

Step 6. Secure the plate with the four screws.

Replacement of Tuner Assembly on R-f/I-f Assembly.

Step 1. Connect plugs P2, P3, and P4. Lower the tuner onto the r-f/i-f assembly.

Step 2. Hold the tuner slightly above the r-f/i-f assembly and turn the crystal drums to align the indexing notch on each dial with the indexing tab on the dial's associated crystal drum.

Note

If the dials should become separated from the tuner switch plates, align the notch on the dial with the indexing tab on the associated tuner switch plate before aligning the dial and crystal drum.

Step 3. Secure the tuner assembly with the four captive screws, and replace the stud and its spring washer.

Step 4. Rotate the cam on the gearing assembly until the lobe of the cam points away from the motor.

Step 5. Check that each latching spring is properly placed under the lip of the relay armature. Check that the latches are holding the drive-pawl levers as shown in Figure 5–15.

Step 6. Place the gearing assembly in position and tighten the two captive screws.

Removal and Replacement of Control Unit Parts. The C-81A, C-88A, CC-11A, and CC-12A use either two type 327 (28-volt) or two type 330 (14-volt) flange-base, midget panel lamps each (see Figure 5–20). To replace a lamp in the C-81A or C-88A, proceed as follows:

Step 1. Unscrew the lamp housing and remove it with the black rubber light shade and lamp.

Step 2. Insert the thin edge of a knife blade, or the fingernails, between the flange base of the lamp and the threaded bushing and withdraw the lamp.

Step 3. Insert a new lamp, seating the flange of the base firmly against the threaded bushing.

Step 4. Replace the lamp housing and screw it back finger-tight.

To replace a lamp in the CC-11A or CC-12A, proceed as follows:

Step 1. Unscrew the cap and spring assembly.

Step 2. Pull the lamp and the black rubber lamp retainer out of the cap and spring assembly.

Step 3. Remove the lamp from the lamp retainer.

Step 4. Place the lamp retainer over the new lamp. Replace the lamp and retainer in the cap and spring assembly.

Step 5. Screw the cap and spring assembly into the light retainer.

All control unit parts, except the channel selector switches, may be replaced easily. Return defective channel selector switches to the factory for repair.

Caution

Excessive soldering iron heat applied to the terminals on the printed-circuit plates of the channel selector switch will affect the position and pressure of the contact springs.

Removal and Replacement of Dynaverter Parts. Figures 5–21, 5–22, and 5–23 show the location of parts within a Dynaverter. The diodes, resistors, and capacitors are accessible with the removal of the top cover, base assembly, and bottom plate. Disassemble the Dynaverter as follows:

Step 1. Remove the screw from the end and the four screws from the top of the cover, and remove the cover.

Step 2. Using a clean cloth, remove the Dow-Corning 4 Compound from the top of the frame assembly.

Step 3. Remove the four screws that attach the base assembly to the bottom plate.

Step 4. Remove the two screws that fasten the bottom plate to the frame assembly transformer.

Note

All parts except the transistors are now accessible. To replace the transistors, C105, and L101 in the DV-10A, must first be removed.

Step 5. To reassemble the Dynaverter, reverse the procedure of Steps 1 through 4. Before replacing the cover, however, apply a thin coating of Dow-Corning 4 Compound to the top of the frame assembly.

Note

For complete Dynaverter maintenance information, refer to the instruction book for the ARC Type DV-10A and DV-11A Dynaverters.

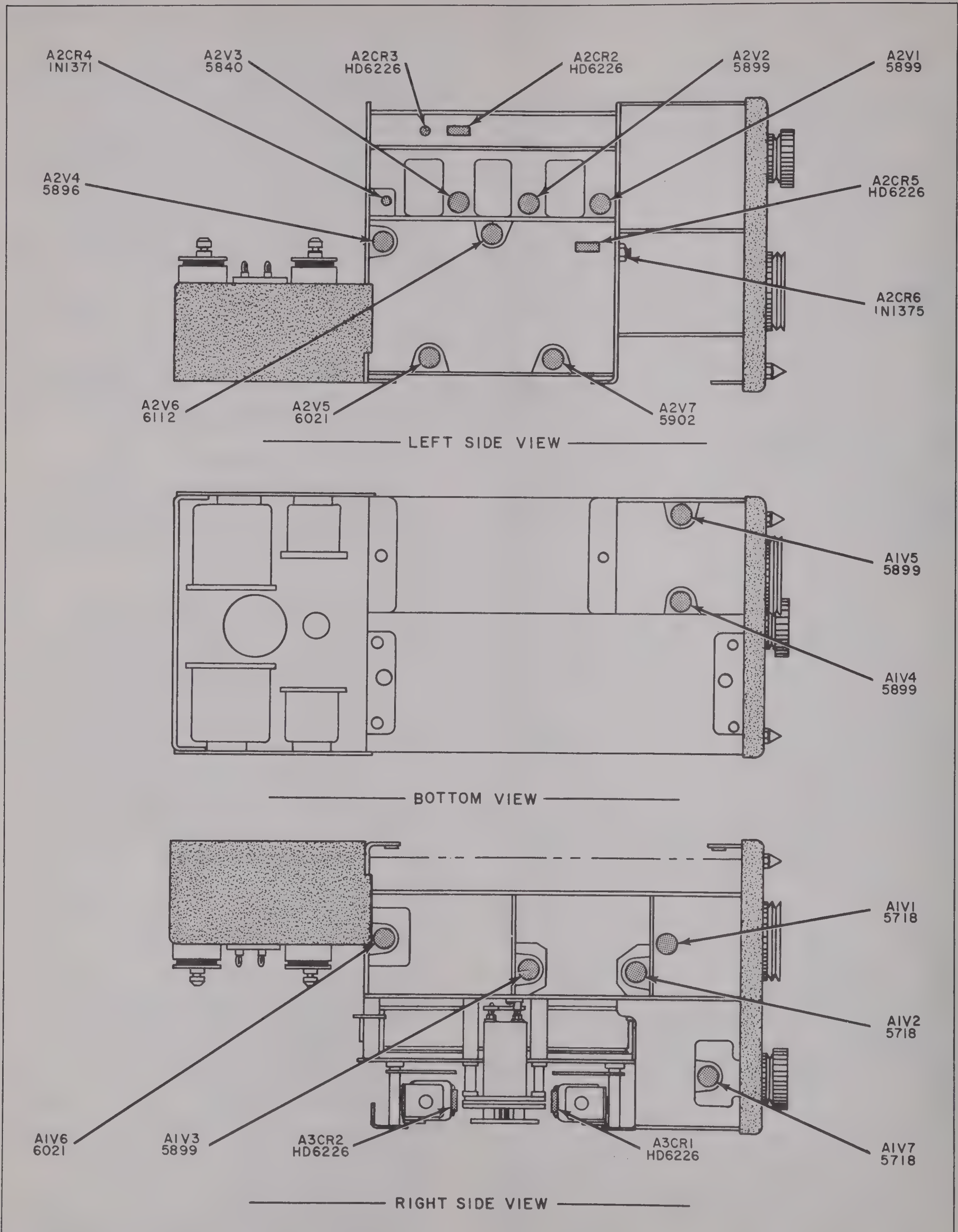


Figure 5–3. R-34A Receiver, Tube and Diode Location Diagram

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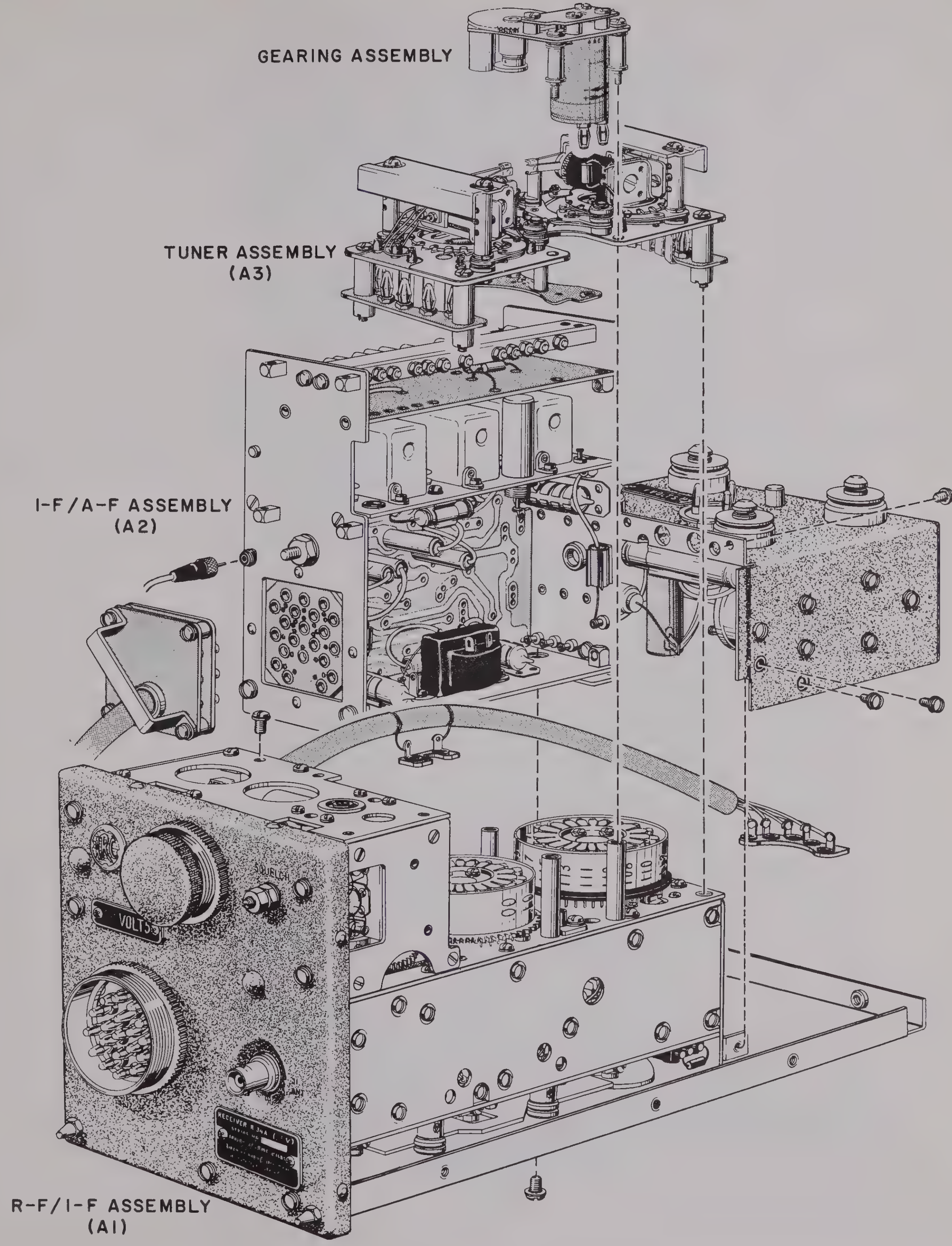

Figure 5–4. R-34A Receiver, Separation of Major Assemblies

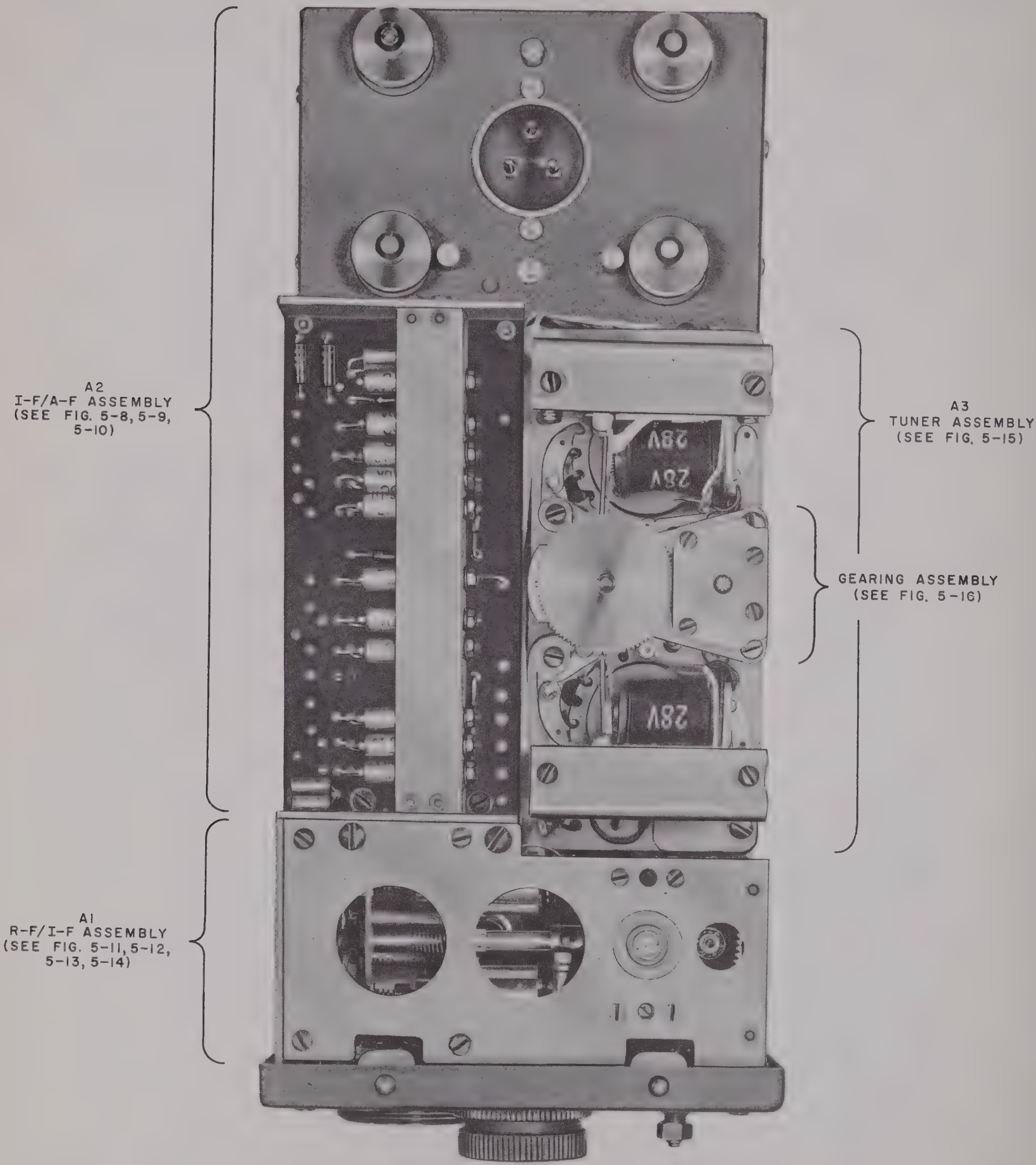

Figure 5–5. R-34A Receiver, Top Interior View

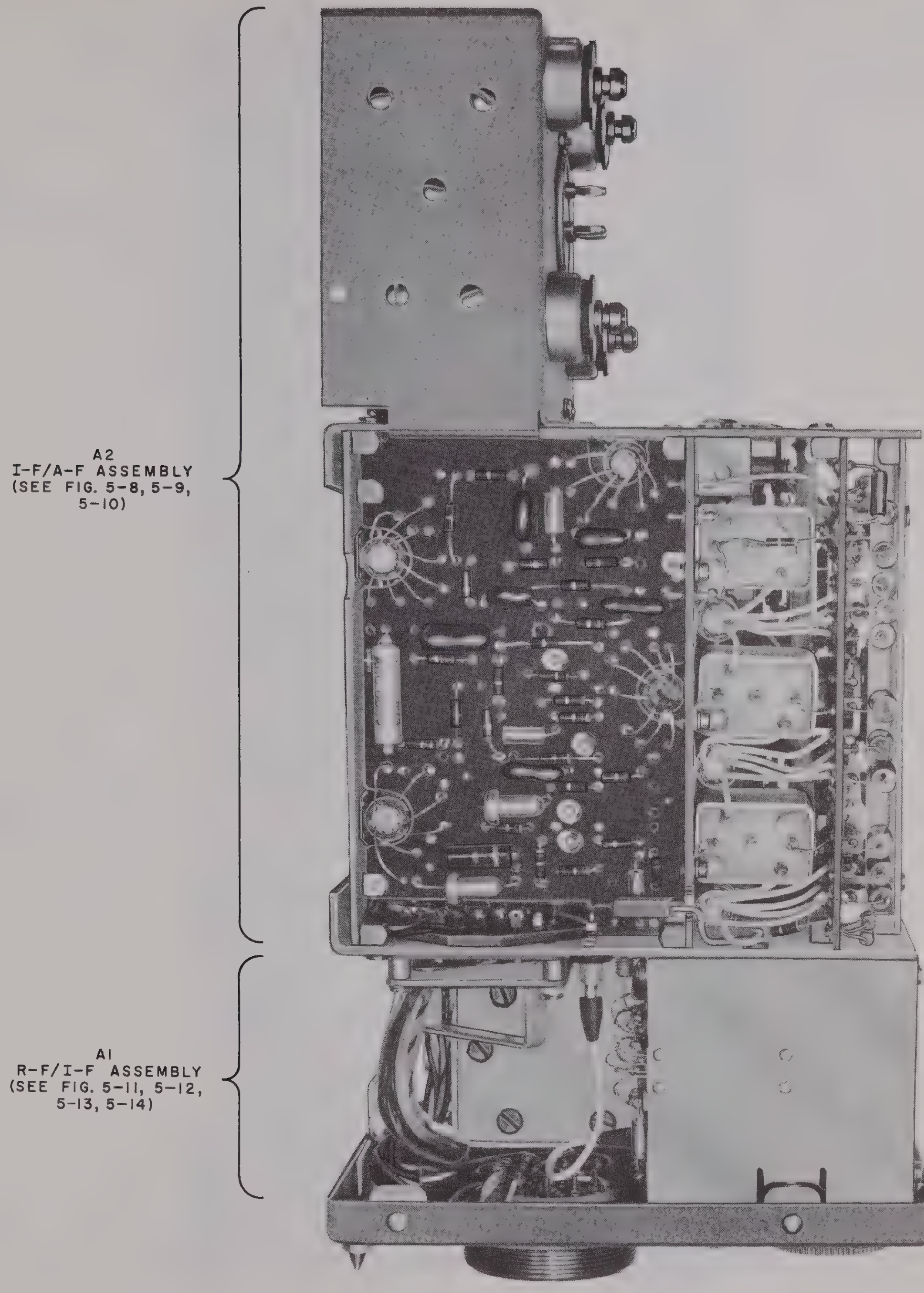

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Figure 5–6. R-34A Receiver, Left Interior View

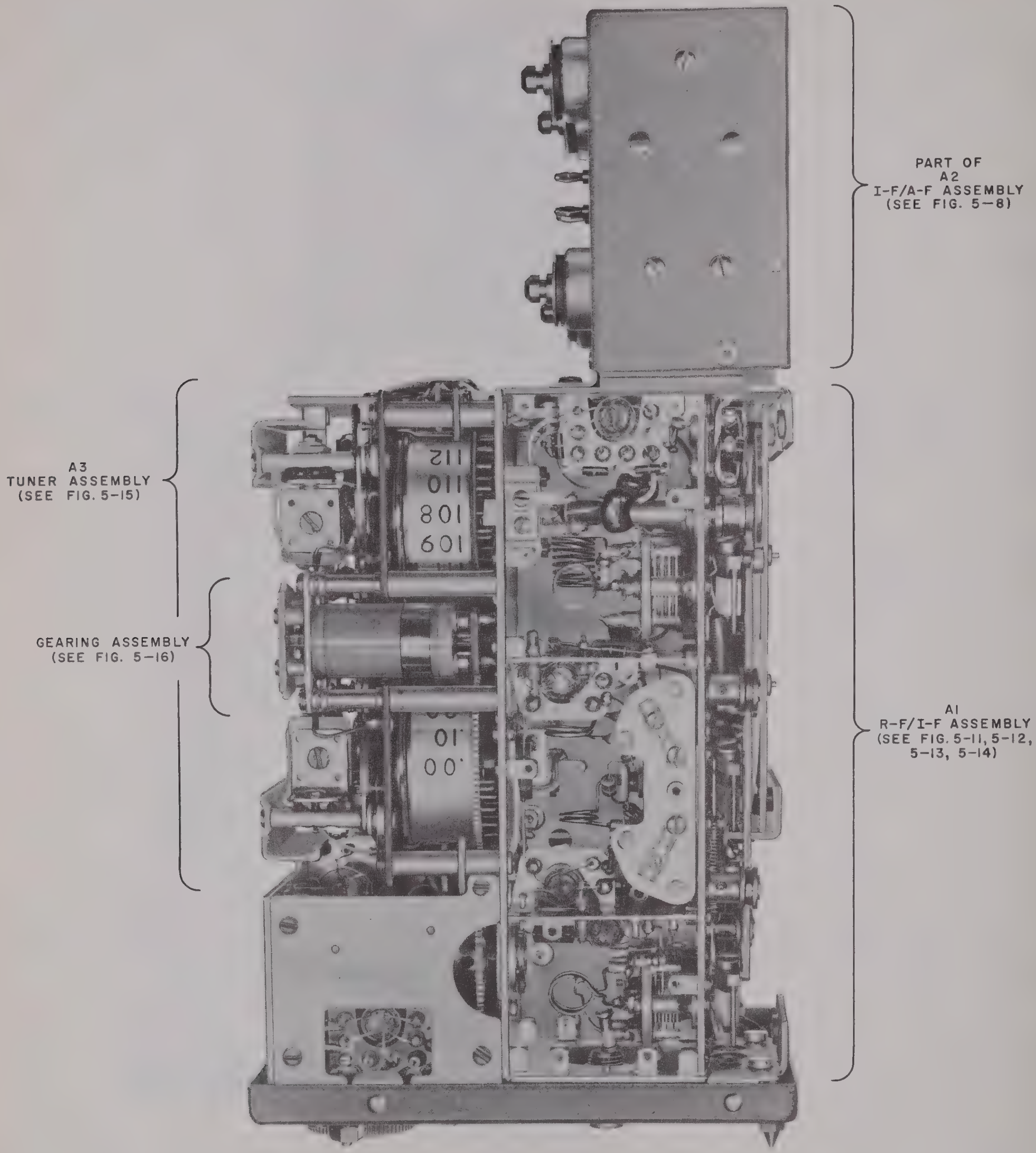
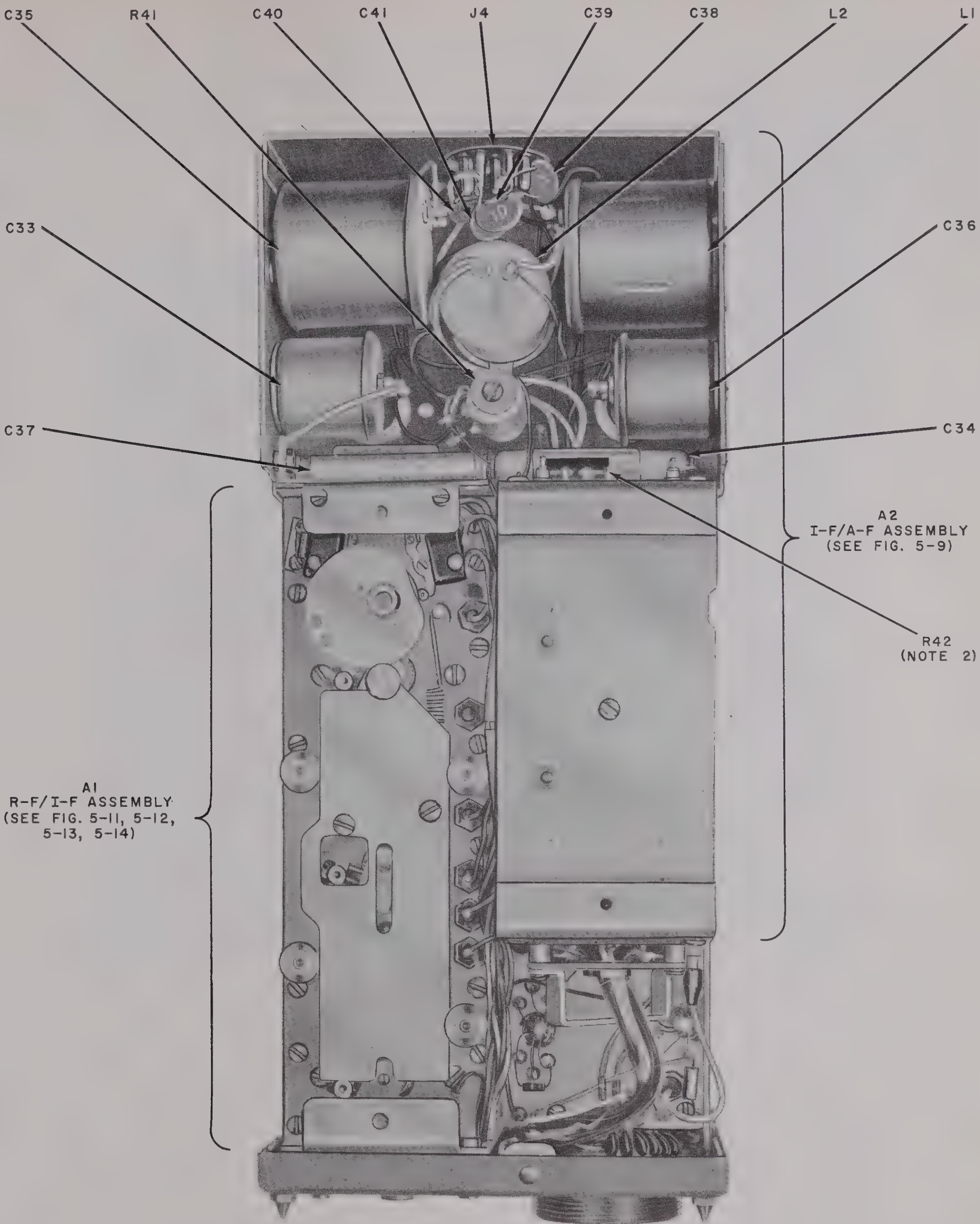


Figure 5–7. R-34A Receiver, Right Interior View



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A2.

2. USED IN 28-VOLT UNITS ONLY.

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Figure 5–8. R-34A Receiver, Bottom Interior View

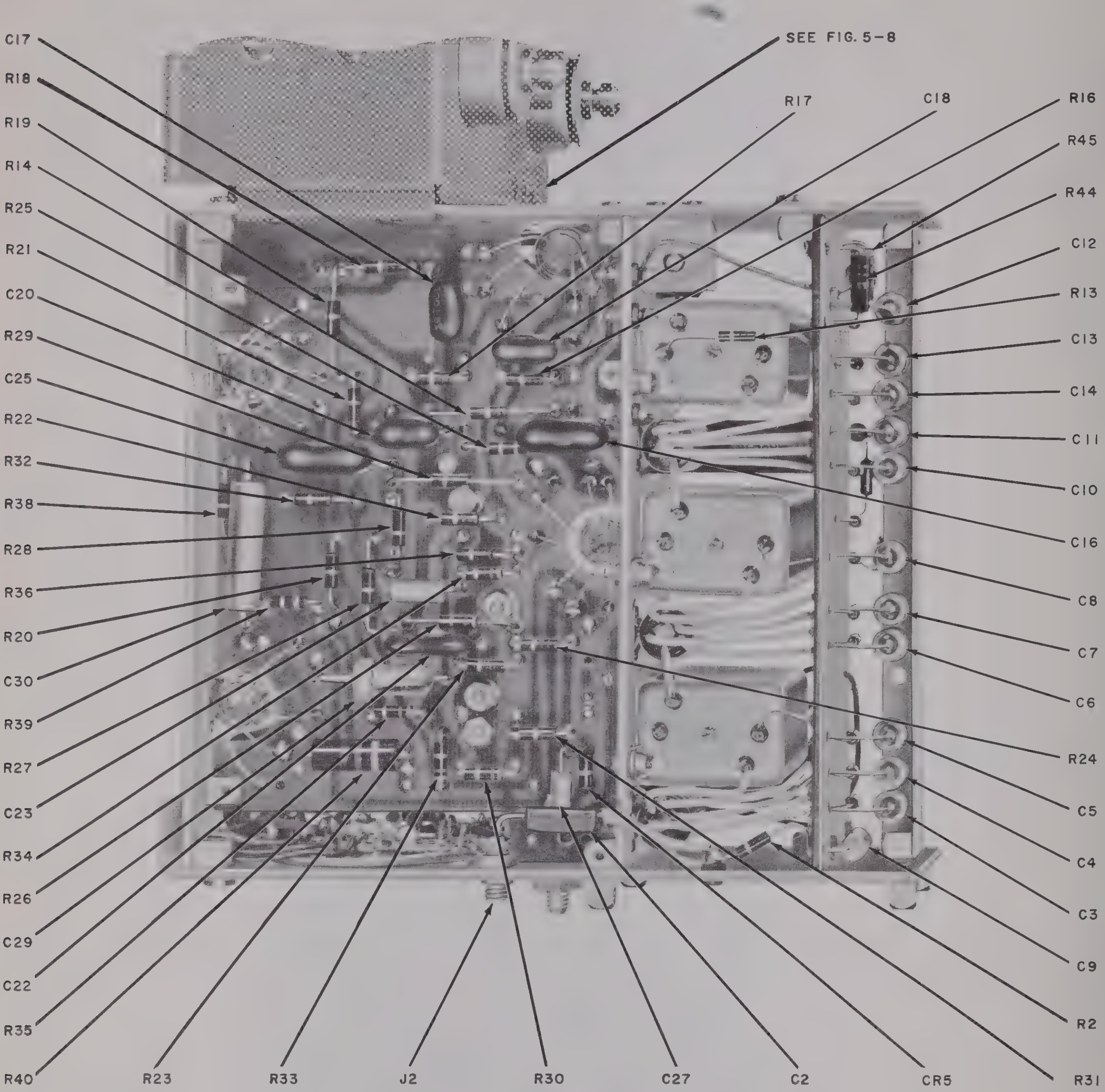

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Figure 5–9. R-34A Receiver, I-f/A-f Assembly, Left Side View

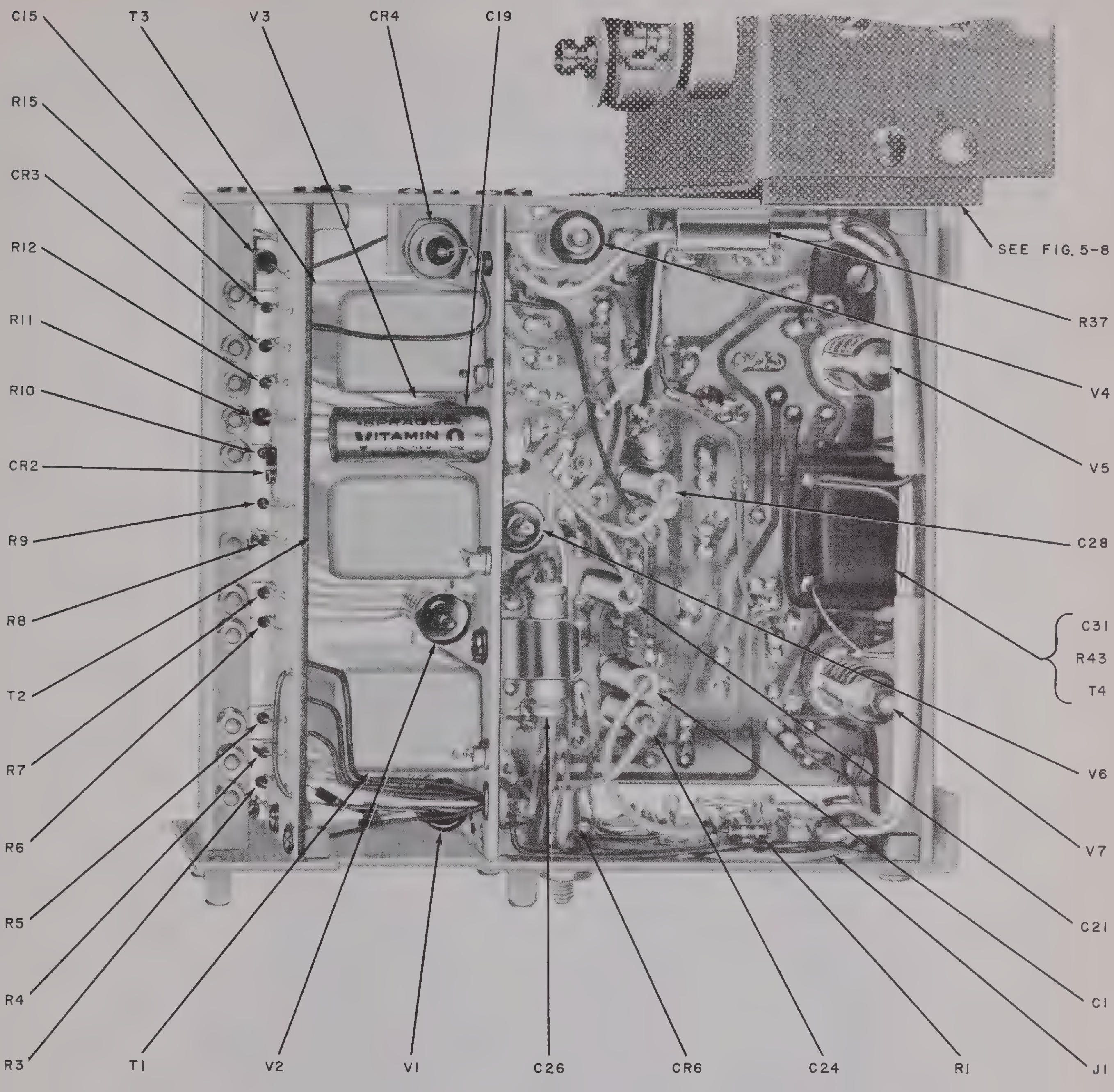

Figure 5–10. R-34A Receiver, I-f/A-f Assembly, Right Side View

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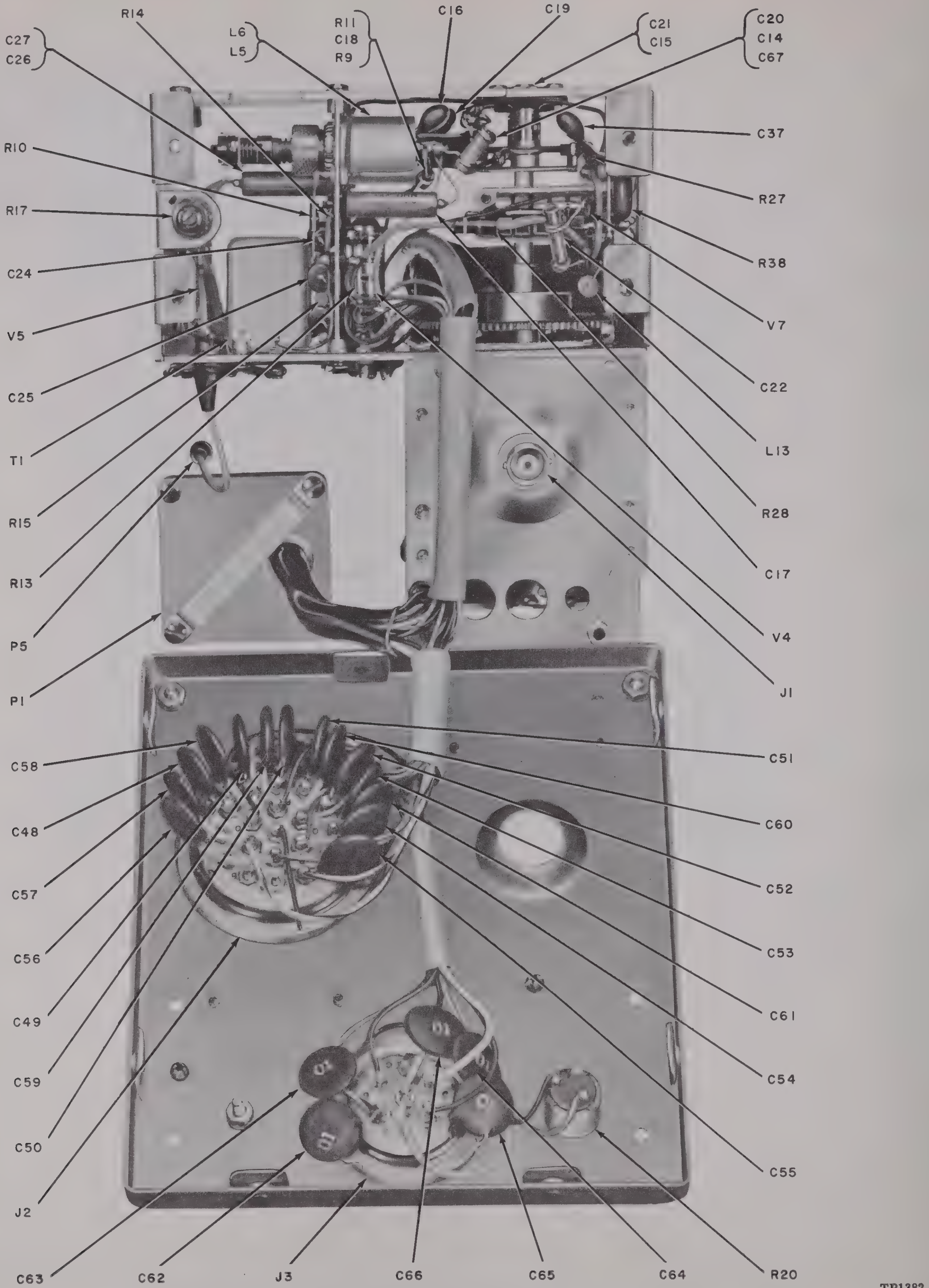


Figure 5–11. R-34A Receiver, R-f/I-f Assembly, Front View

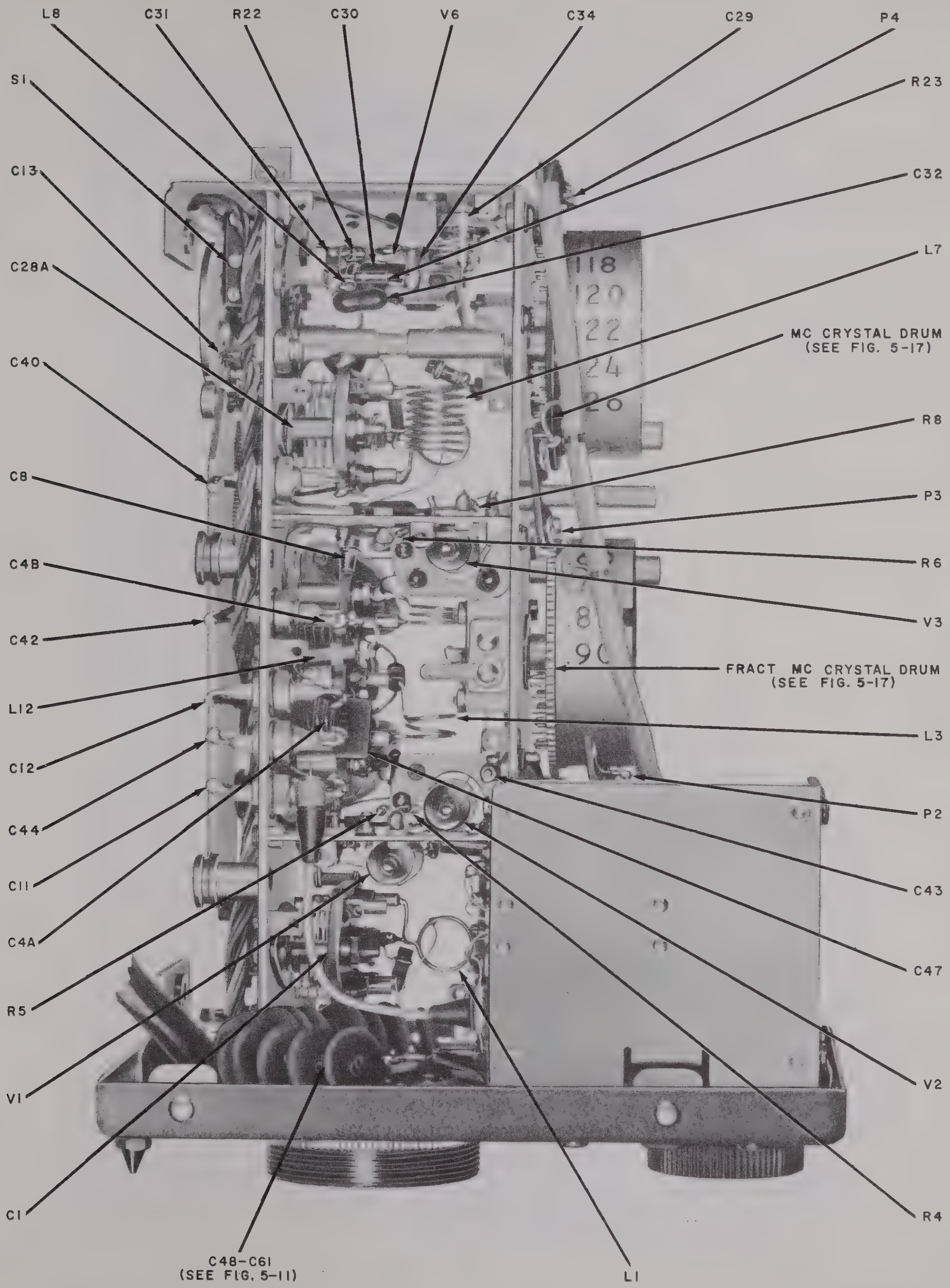


Figure 5–12. R-34A Receiver, R-f/I-f Assembly, Left Side View

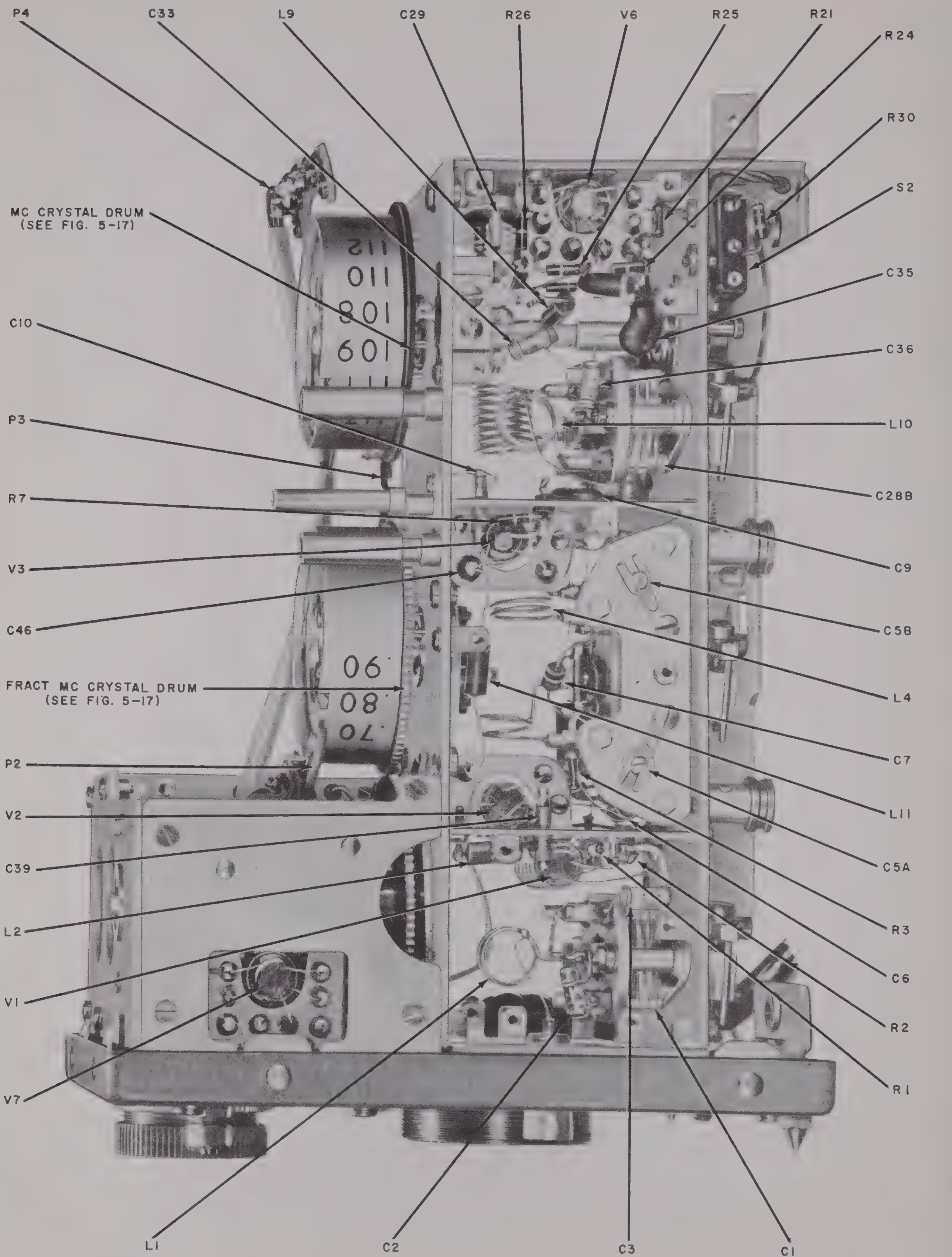


Figure 5–13. R-34A Receiver, R-f/I-f Assembly, Right Side View

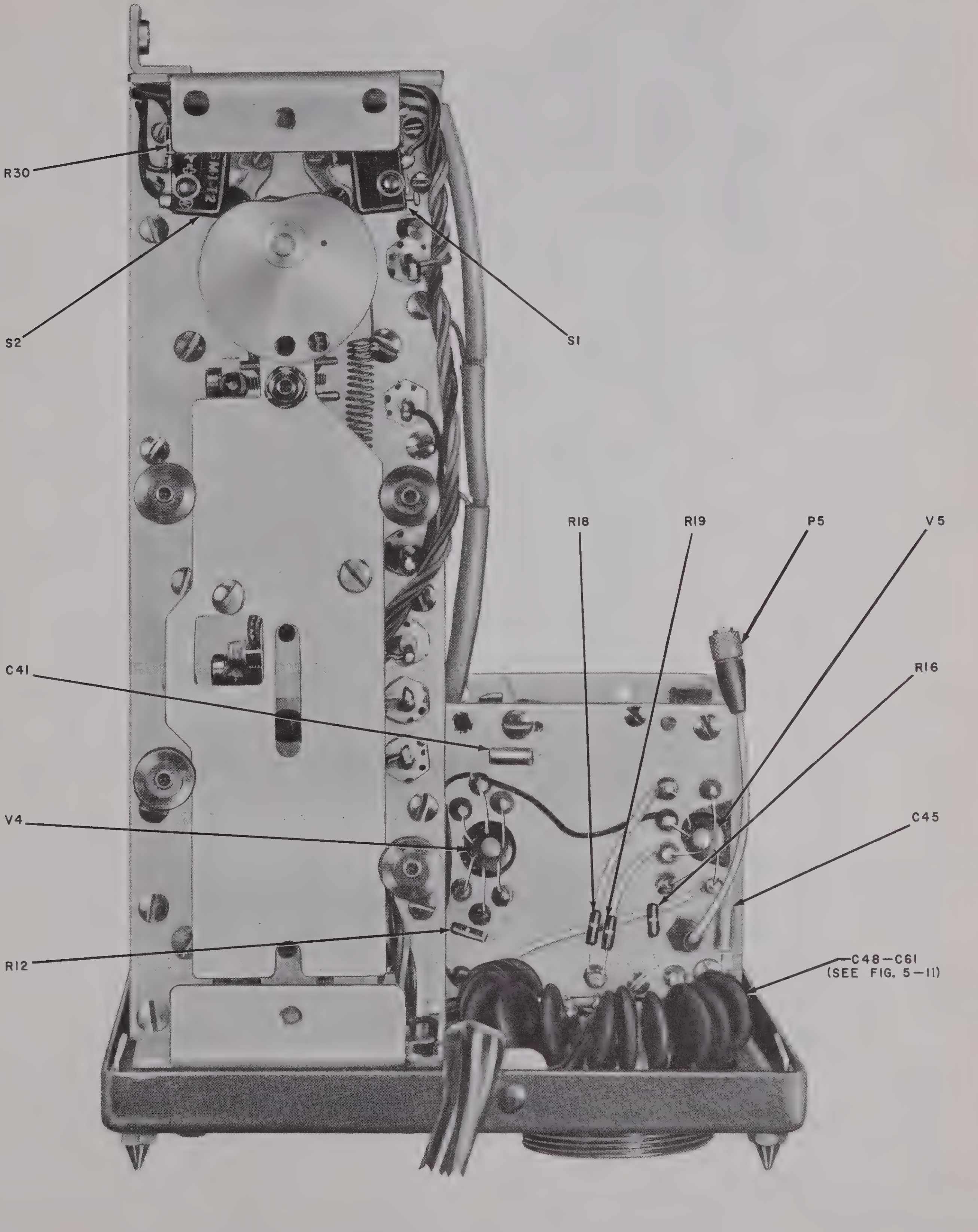


Figure 5–14. R-34A Receiver, R-f/I-f Assembly, Bottom View

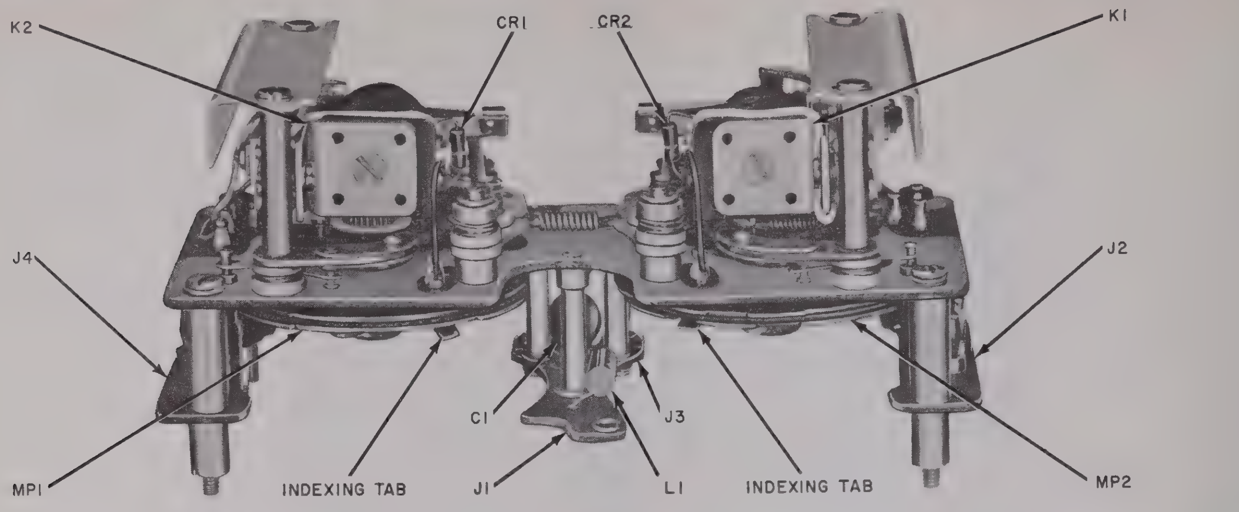


Figure 5–15. R-34A Receiver, Tuner Assembly, Right Side View

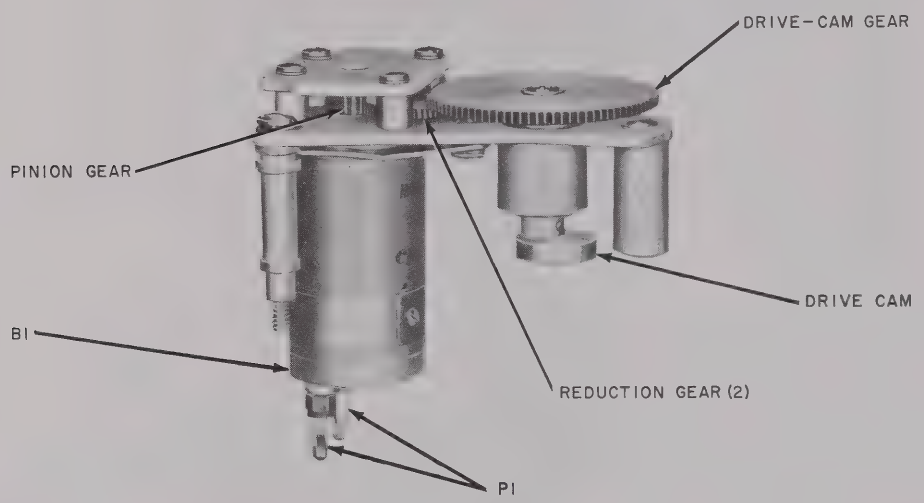


Figure 5–16. R-34A Receiver, Gearing Assembly

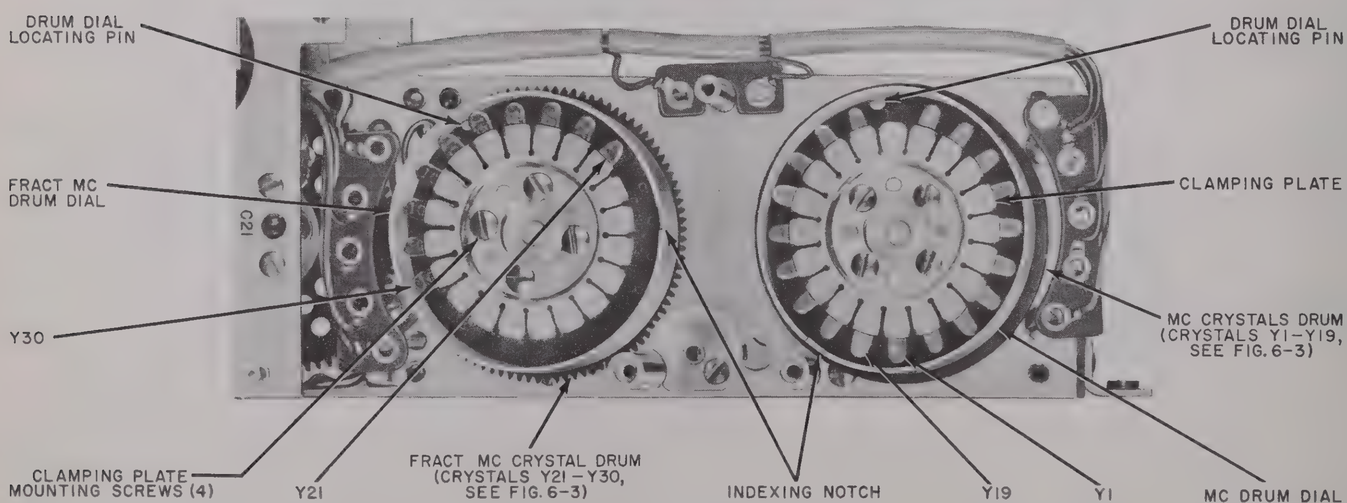


Figure 5–17. R-34A Receiver, Crystal Drums

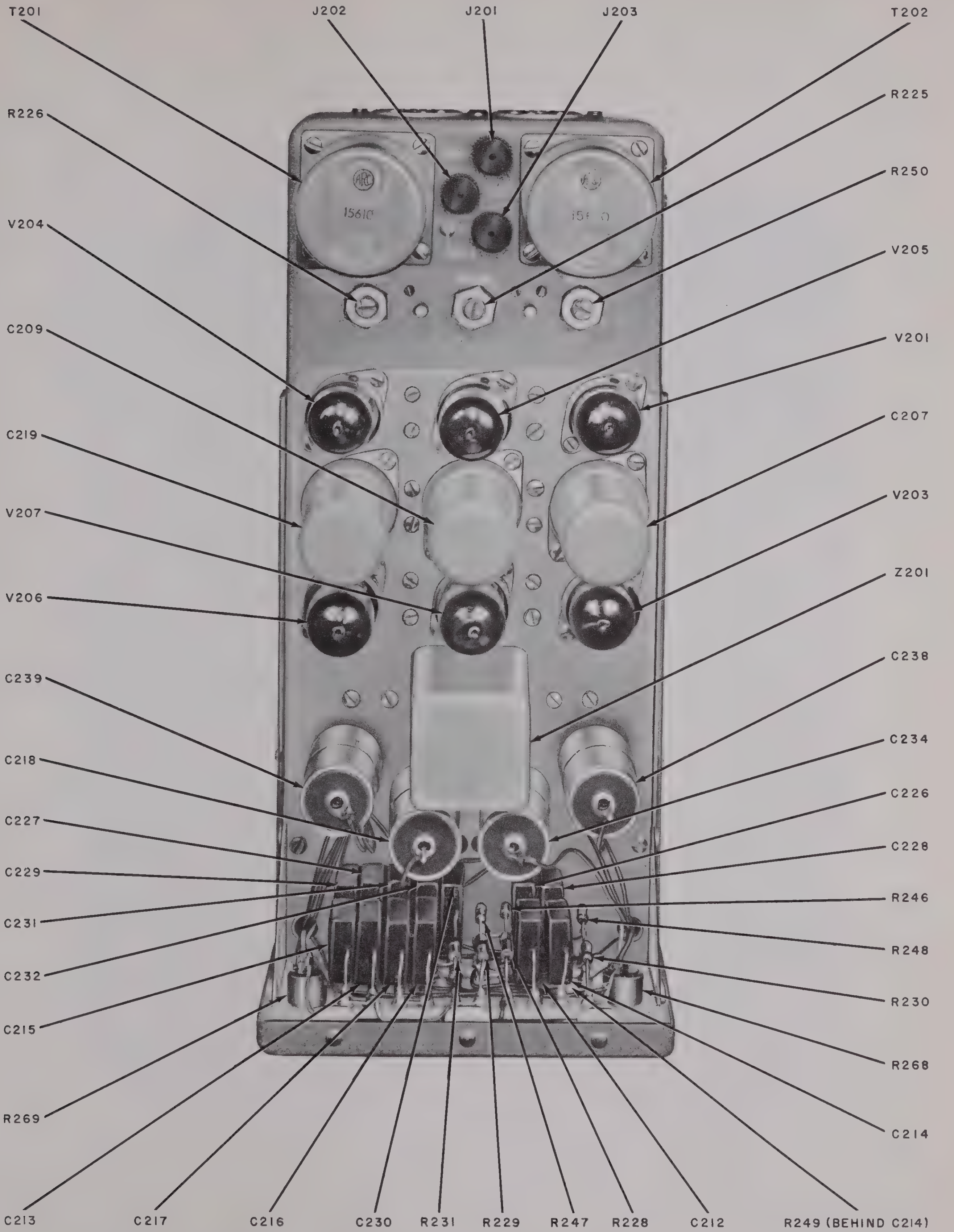


Figure 5–18. B-13A-1 Converter, Top Interior View

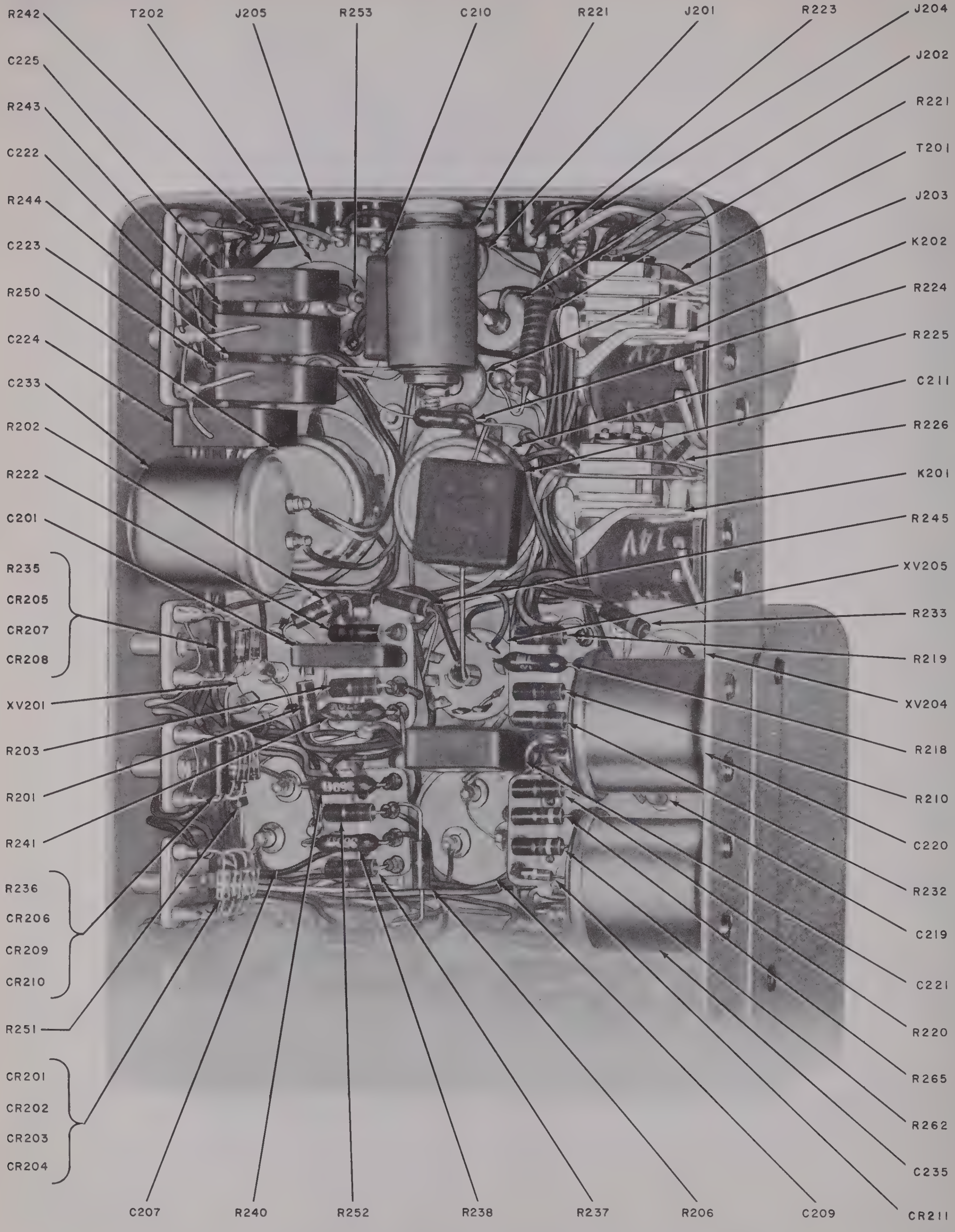


Figure 5–19. B-13A-1 Converter, Bottom Interior View (Sheet 1 of 2)

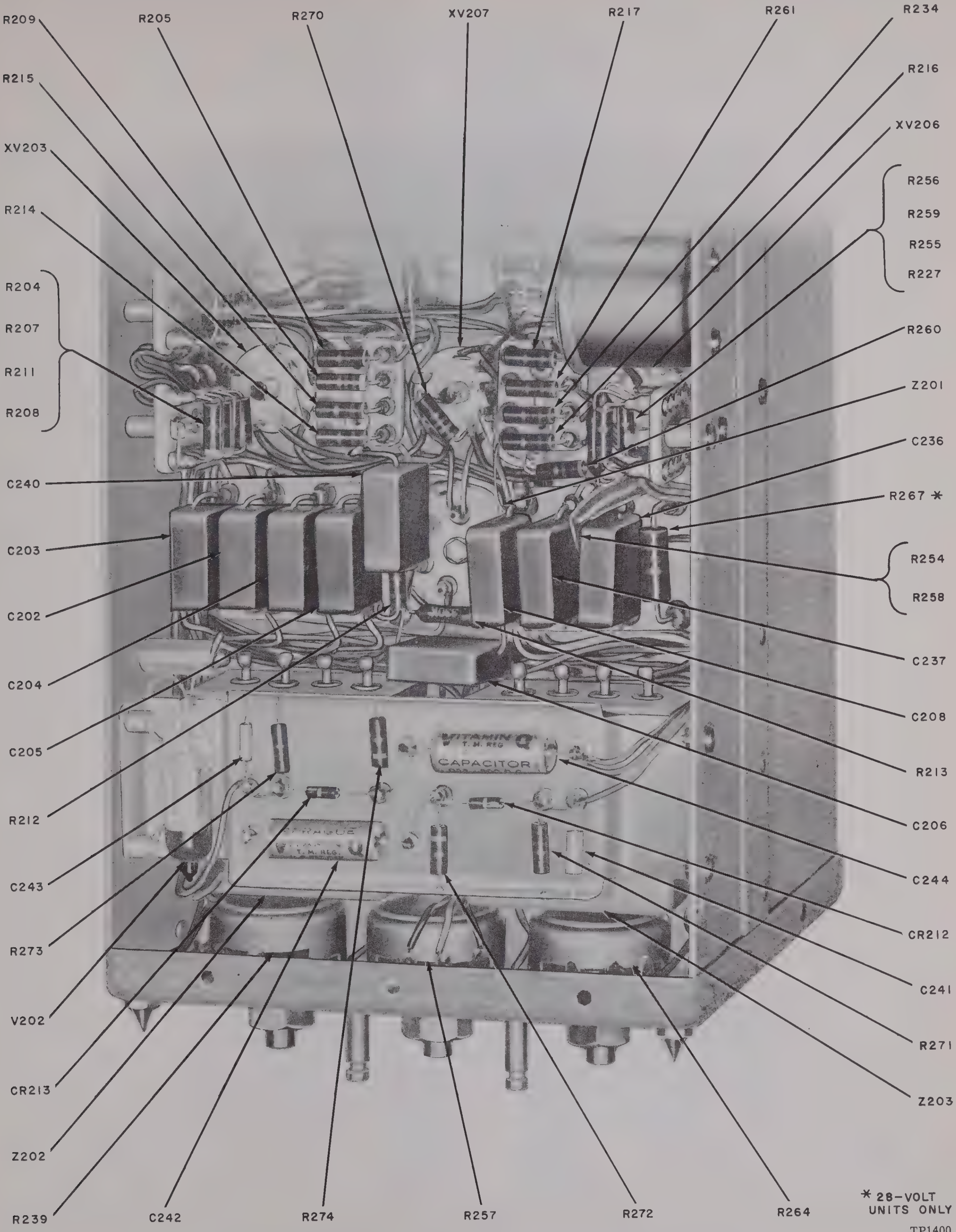
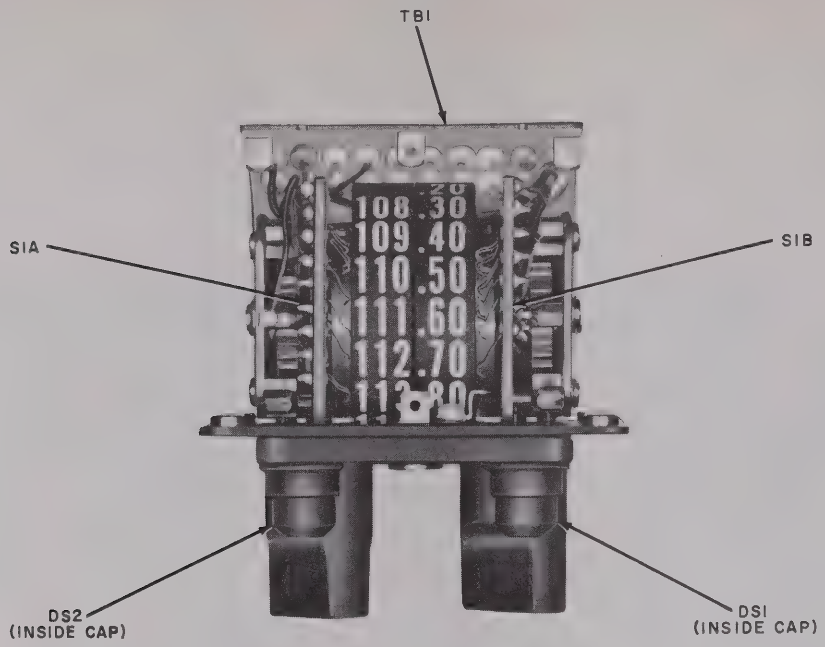


Figure 5–19. B-13A-1 Converter, Bottom Interior View (Sheet 2 of 2)



CC–11A

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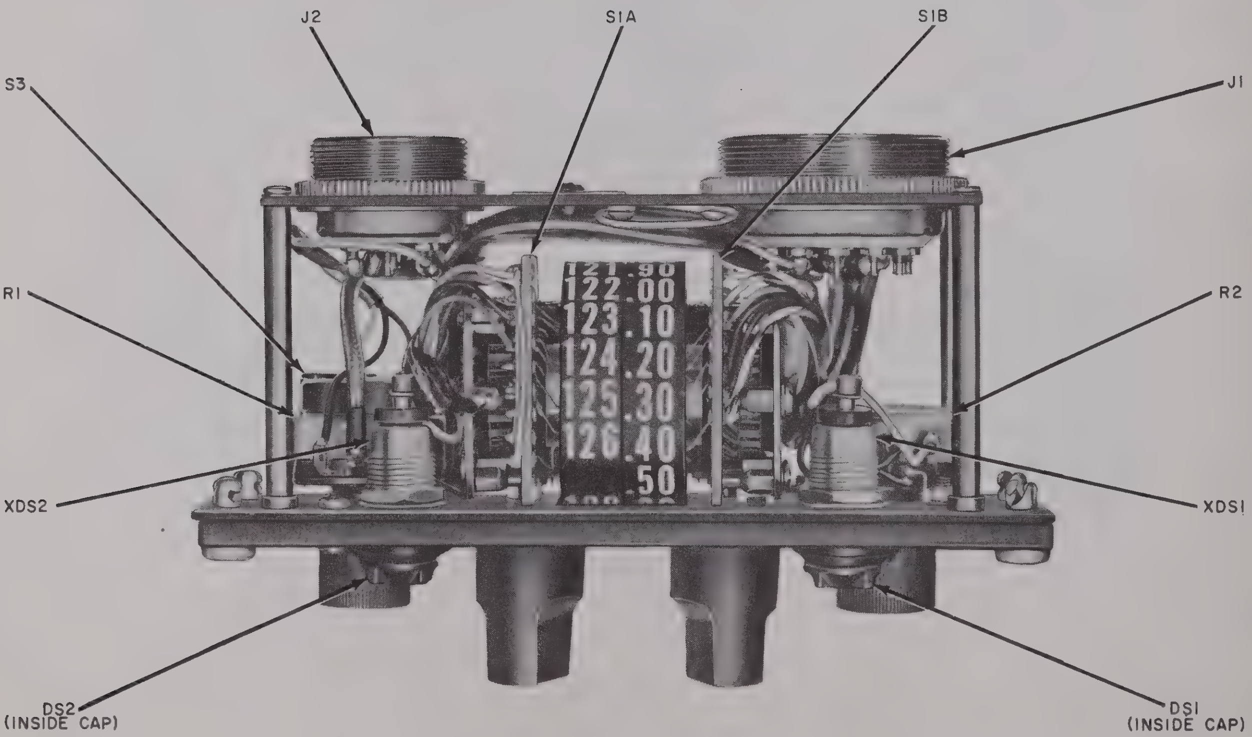

C–81A

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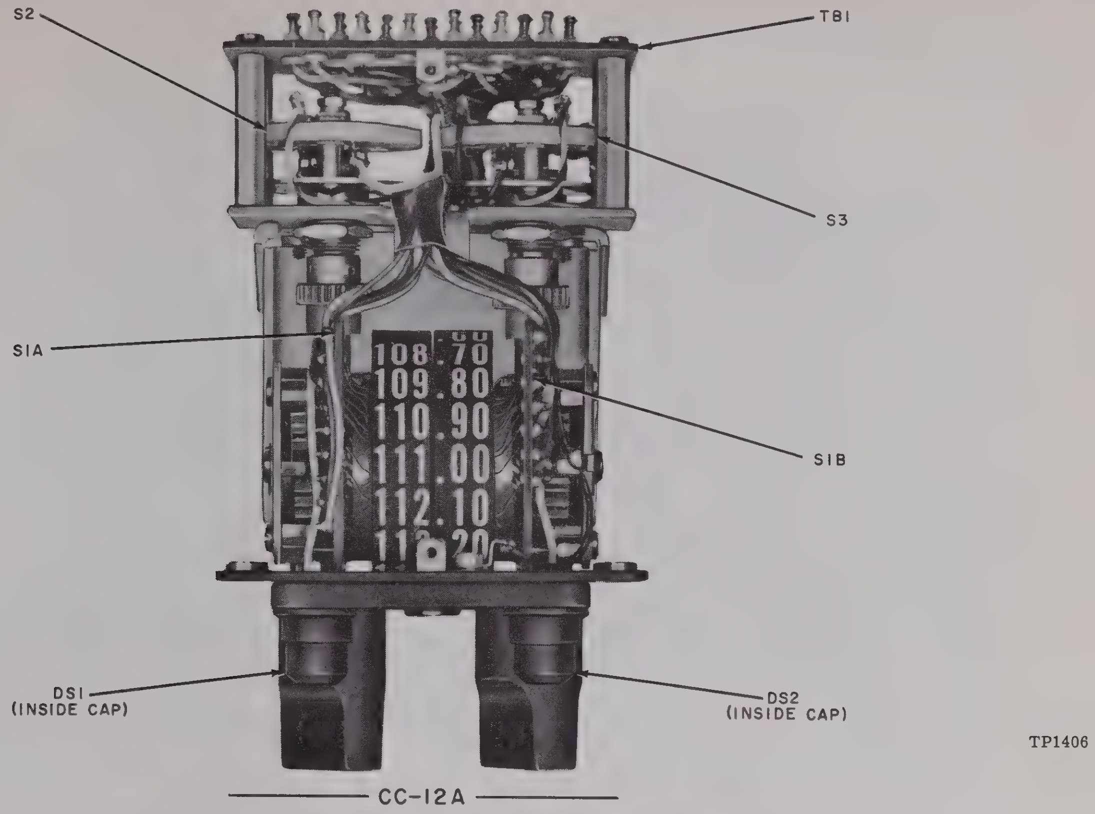
Figure 5–20. Control Units, Top Interior Views (Sheet 1 of 2)



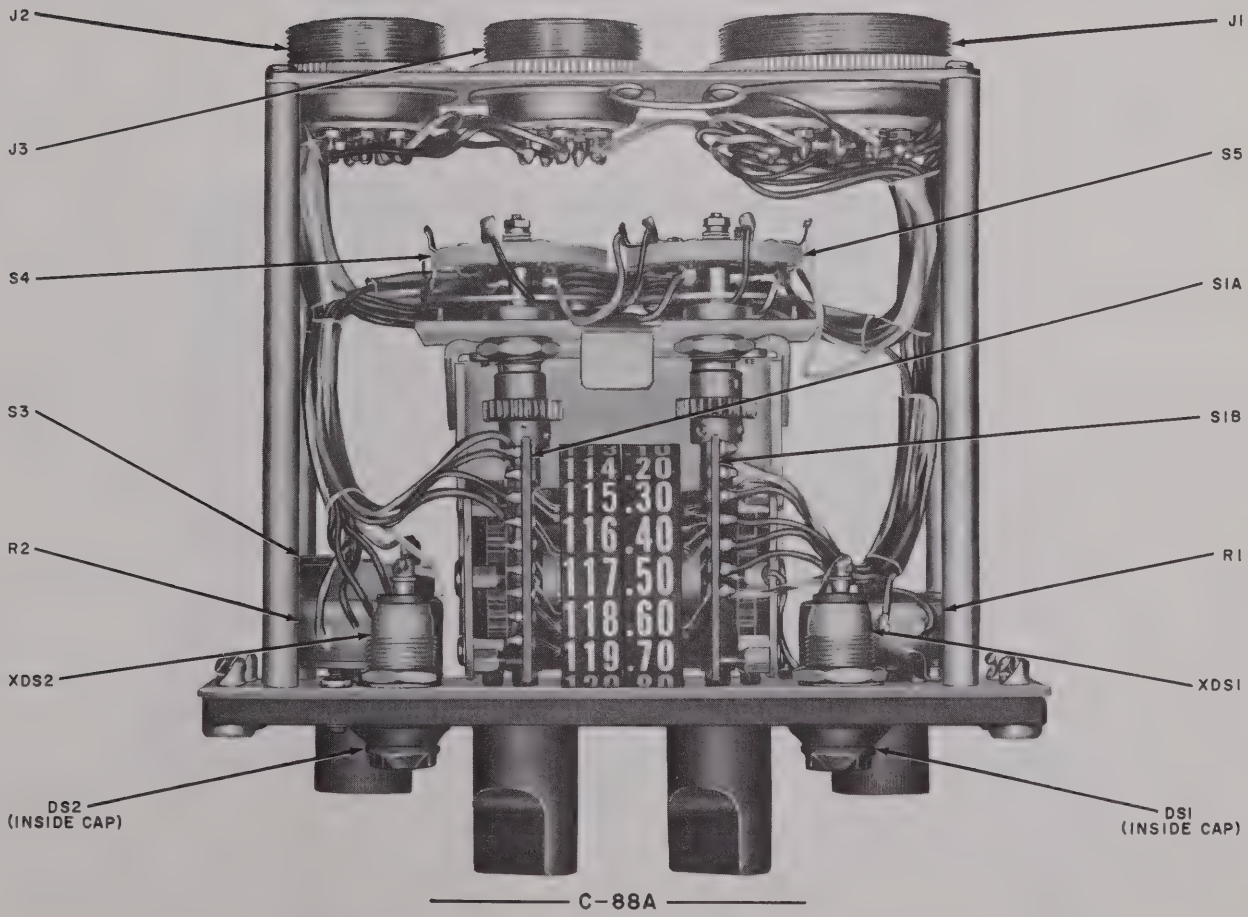


Figure 5–20. Control Units, Top Interior Views (Sheet 2 of 2)

TP1408

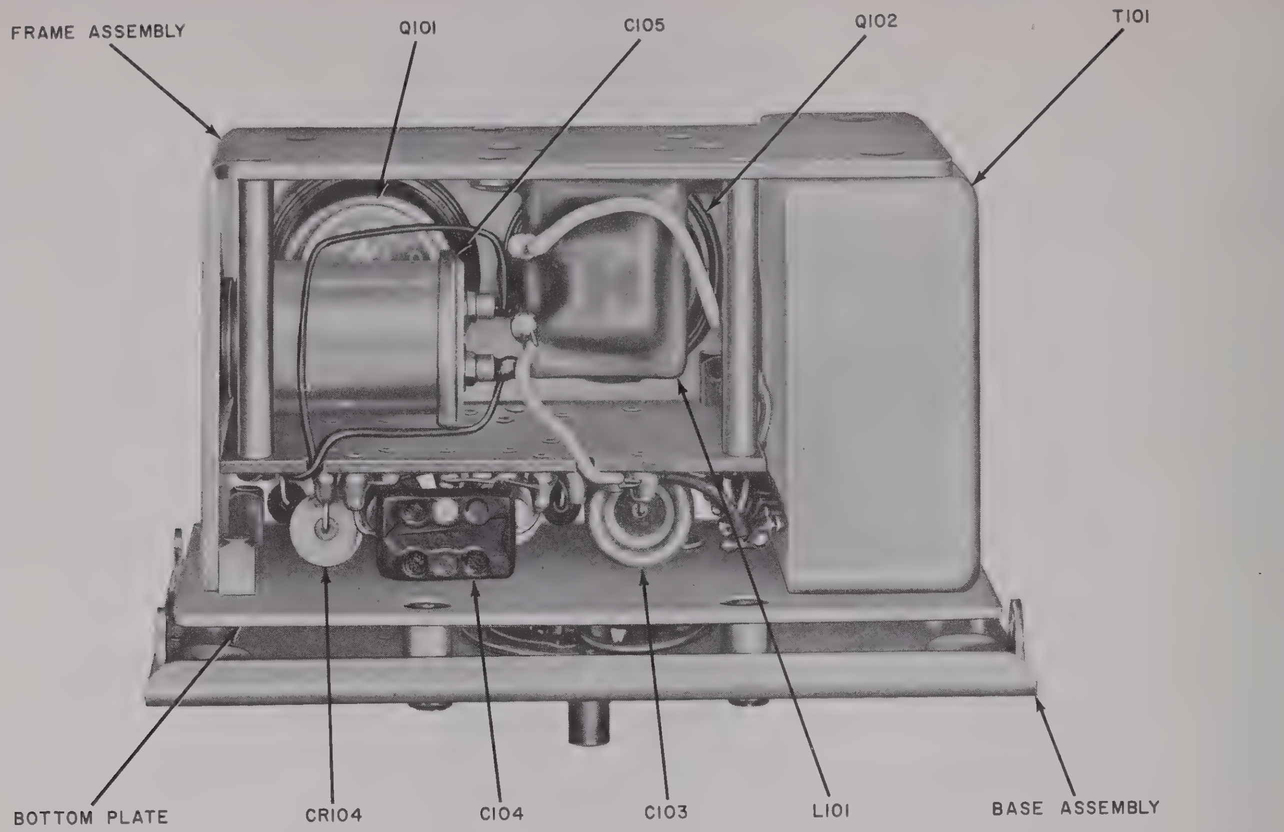


Figure 5–21. DV-10A Dynaverter, Front Interior View

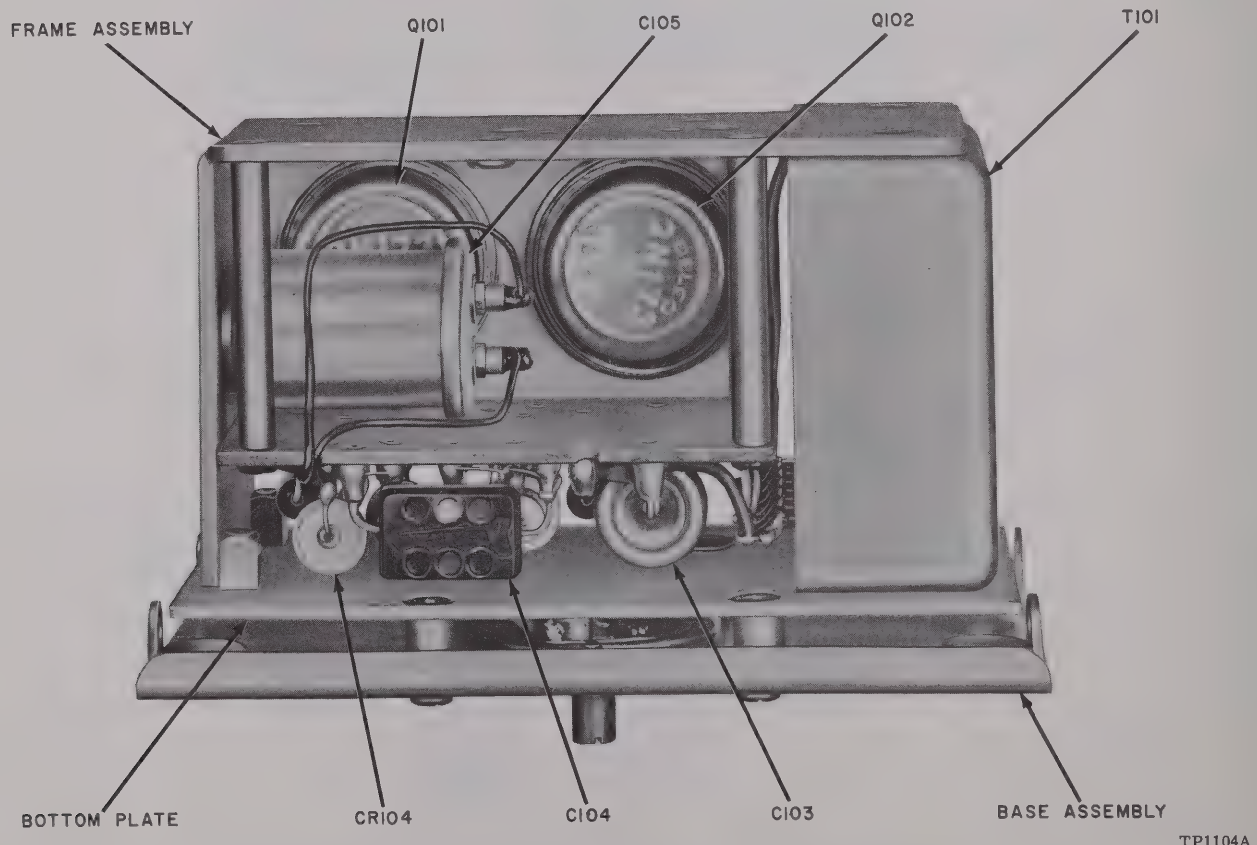


Figure 5–22. DV-11A Dynaverter, Front Interior View

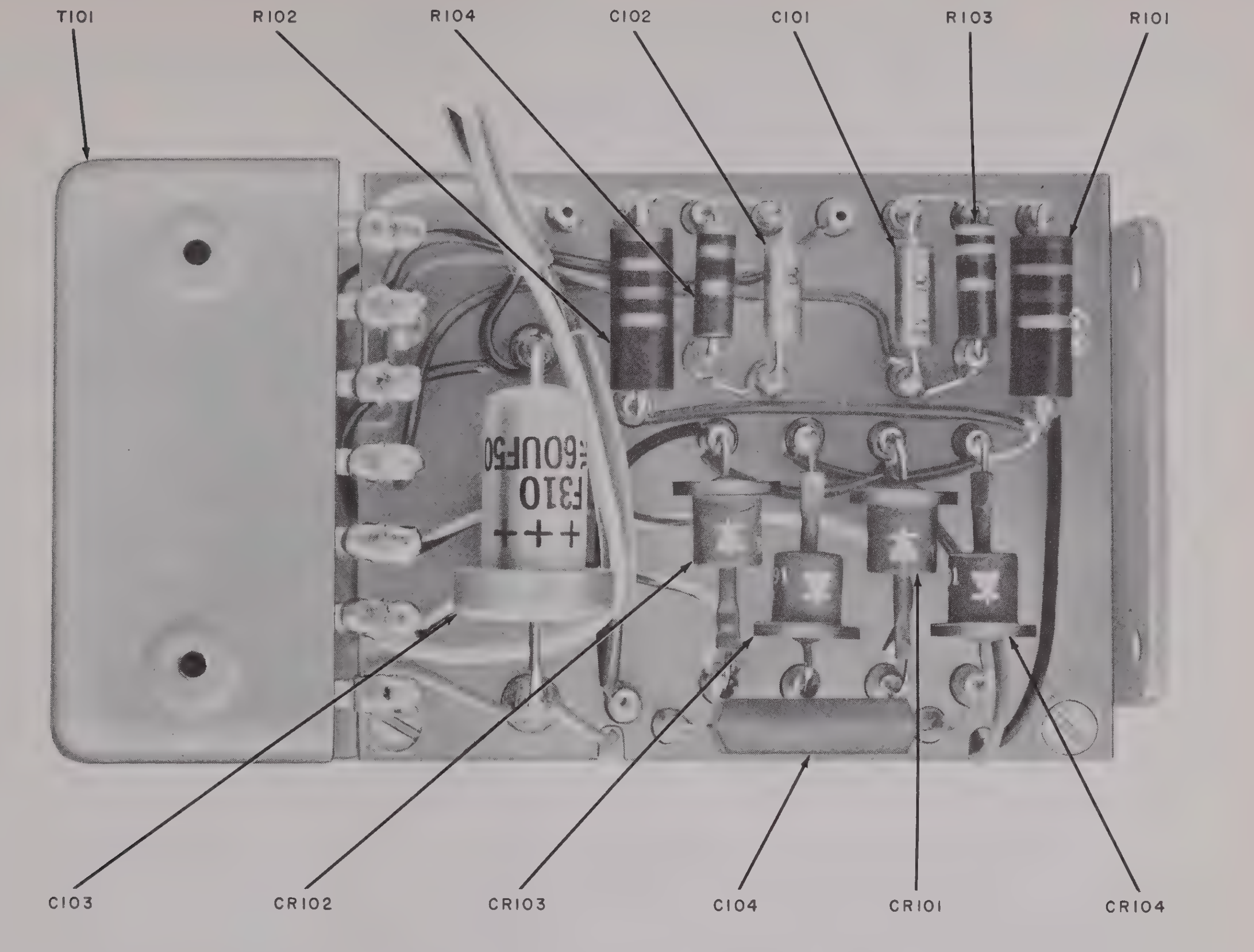


Figure 5–23. DV-10A and DV-11A Dynaverters, Terminal Board

5–5. EQUIPMENT PERFORMANCE CHECKS.

General. Table 5–3 outlines the procedures for checking the performance of the Type 15F. The test equipment required is listed in Table 5–1. Figure 5–24 illustrates the bench test setup using an ARC Type BTK-15F Bench Test Kit. The bench test setup without the BTK-15F is shown in Figure 5–25.

Test Conditions. Unless otherwise specified, the following test conditions apply when using either bench test setup.

Input Power. 4.9 amperes at 13.75 volts dc (14-volt models) or 2.5 amperes at 27.5 volts dc (28-volt models).

Audio Output Load. A 300-ohm, noninductive, audio load resistor is provided in the BTK-15F. To avoid shunting the resistor, keep the volume control knob on the control unit at its full clockwise (maximum) position. If a headset of less than 5000 ohms impedance is used during the tests, disconnect the headset while taking audio-output voltage measurements at the TEL V. test point on the receiver test harness.

Converter Output Load. The B-13A-1 Converter is designed to operate three parallel-connected, 1000-ohm vertical pointer meters and three parallel-connected, 1000-ohm flag meters, or equivalent loads (330 ohms total). See Figures 6–26 and 6–30.

Signal Generator Output. The method of connecting the receiver to the signal generator must be carefully considered to insure proper interpretation of results. All signal generator output microvolt values given in the following procedures are in terms of hard [1] microvolts. When using the Boonton Radio Corp. Type 505-B 6-db Attenuator, the attenuator dial of the signal generator reads hard microvolts directly. If the signal generator output is connected to the receiver without the use of the 6-db pad, the attenuator dial reading must be doubled to give the correct hard-microvolt reading.

[1] Hard microvolts are defined as equivalent open-circuit microvolts across a 50-ohm signal source.

TABLE 5–3. TYPE 15F PERFORMANCE CHECKS

Step	Procedure With BTK-15F	Procedure Without BTK-15F	Normal Indications
	PRELIMINARY PROCEDURE		
1	Remove top covers and bottom plates from R-34A Receiver and B-13A-1 Converter. Remove side plates from R-34A. Interconnect Type 15F and required test equipment as shown in Figure 5–24. (Unconnected test equipment shown in the illustration is to be connected when so directed in this procedure.)	Same as with BTK-15F, except interconnect Type 15F and test equipment as shown in Figure 5–25.	None.
2	Connect the Simpson Model 260 Multimeter (50-volt dc range) between LV+ and G of receiver test harness. Turn on primary power source. Turn control unit OFF-VOL control clockwise to turn equipment on and to adjust audio output to a desired level. Turn control unit SQUELCH control clockwise to quiet receiver. Set channel selector switches to 110.90 mc.	Same as with BTK-15F, except connect the multimeter (50-volt dc range) between J2 and J3 of test panel.	Meter reads 28 volts. Receiver and converter tube filaments light.
3	Connect multimeter (1000-volt dc range) between HV+ and G of receiver test harness. Adjust primary voltage until meter reads 240 volts. **Caution** Keep the primary voltage within the rated voltage limits of the equipment.	Same as with BTK-15F, except connect multimeter between J1 and J2 of test panel.	None.
4	Prepare the ARC Type H-14A Signal Generator for use as outlined in the H-14A instruction book.	Same as with BTK-15F.	None.
	RECEIVER CHANNELING		
1	Perform Steps 1 through 3 of the preliminary procedure outlined in this table.	Same as with BTK-15F.	None.
2	Operate megacycle channel selector switch to select each megacycle channel. Observe cycling test unit for proper lighting sequence.	Operate megacycle channel selector switch to select each megacycle channel. Observe receiver megacycle crystal drum position for each selector switch setting.	Crystal drum indexes to frequency selected on control unit.
3	Operate fractional megacycle channel selector switch to select each tenth-megacycle channel. Observe cycling test unit for proper lighting sequence.	Operate fractional megacycle channel selector switch to select each tenth-megacycle channel. Observe receiver fractional megacycle crystal drum position for each selector switch setting.	Crystal drum indexes to frequency selected on control unit.
4	Reduce primary voltage to 20.0 volts (10 volts for 14-volt models), and repeat Steps 2 and 3.	Same as with BTK-15F.	Same as Steps 2 and 3, but operation is slower.
5	Readjust primary voltage to obtain an HV+ of 240 volts dc.	Same as with BTK-15F.	None.
	RECEIVER SENSITIVITY		
1	Perform Steps 1 through 3 of the preliminary procedure outlined in this table.	Same as with BTK-15F.	None.
2	Connect Boonton Radio Type 211-A Signal Generator through the 6-db Boonton Radio Type 505-B Attenuator to ANT jack (J1) on the R-34A. Connect a Ballantine Model 300 vtvm between TEL V. and G terminals of receiver test harness.	Connect Ballantine Model 300 vtvm between J6 and J9 of test panel.	None.

TABLE 5–3. TYPE 15F PERFORMANCE CHECKS — Continued

Step	Procedure With BTK-15F	Procedure Without BTK-15F	Normal Indications
	RECEIVER SENSITIVITY—Continued		
3	Apply power to signal generator and vtvm.	Same as with BTK-15F.	None.
4	Set control unit channel selector switches to 108.00 mc and SQUELCH control fully counterclockwise. Adjust the 211-A Signal Generator for a 126.90-mc output signal modulated 30% by a 1000-cps signal. Set signal generator attenuator dial at 3.0 μv.	Same as with BTK-15F.	None.
5	Tune signal generator for a maximum TEL output at approximately 108.00 mc. Adjust control unit OFF-VOL control for a +14-db (5-volt) TEL V. output.	Same as with BTK-15F.	None.
6	Reduce output level of signal generator until receiver TEL V. output is reduced 6 db when the 1000-cps modulation is removed (6-db S+N/N).	Same as with BTK-15F.	Signal generator output level should not exceed 3.0 μv for the 6-db S+N/N.
	RECEIVER AGC OPERATION		
1	Perform Steps 1 through 3 of the preliminary procedure outlined in this table.	Same as with BTK-15F.	None.
2	Connect Boonton Radio Type 211-A Signal Generator through the 6-db Boonton Radio Type 505-B Attenuator to the ANT jack (J1) on the R-34A. Connect Ballantine Model 300 vtvm between TEL V. and G terminals of receiver test harness.	Connect Ballantine Model 300 vtvm between J6 and J9 of test panel.	None.
3	Apply power to signal generator and voltmeter. Set control unit channel selector switches to 108.00 mc and turn SQUELCH control fully counterclockwise. Adjust signal generator for a 108.00-mc output signal modulated 30% by a 1000-cps signal. Set signal generator attenuator dial at 3.0 μv.	Same as with BTK-15F.	None.
4	Tune signal generator for a maximum TEL V. output at approximately 126.90 mc. Adjust control unit OFF-VOL control for a +14-db (5-volt) TEL V. output.	Same as with BTK-15F.	None.
5	Increase signal generator attenuator dial setting to 100,000 μv and note db rise in TEL V. output.	Same as with BTK-15F.	The rise should be between +4 and +6 db.
6	Increase signal generator attenuator dial setting to 200,000 μv and note db rise in the TEL V. output from initial reading (Step 4).	Same as with BTK-15F.	The rise should be between +6 and +8 db.
	CONVERTER VOR OPERATION		
1	Perform Steps 1 through 4 of the preliminary procedure outlined in this table.	Same as with BTK-15F.	None.
2	Connect Ballantine Model 300 vtvm between NAV MOD V. and G test points of receiver test harness. Set receiver test harness NAV MOD SOURCE switch to EXTERNAL. Connect DEMOD output of ARC Type H-14A Signal Generator to EXT NAV MOD connector of receiver test harness.	Connect Ballantine Model 300 vtvm between J2 and J5 of test panel. Set test panel switch S1 to EXT. Connect DEMOD output of ARC Type H-14A Signal Generator to J4 of test panel.	None.

TABLE 5–3. TYPE 15F PERFORMANCE CHECKS — Continued

Step	Procedure With BTK-15F	Procedure Without BTK-15F	Normal Indications
	CONVERTER VOR OPERATION—Continued		
3	Set control unit channel selector switches to 114.90 mc and H-14A crystal switch MC to B (114.90 mc). Set H-14A MODULATION switch to 30~ and adjust DEMOD output level to obtain a NAV MOD V. reading of 1.8 volts on the vtvm. Set H-14A MODULATION switch to OMNI.	Same as with BTK-15F.	None.
4	Check accuracy of B-13A-1 Converter for each of the 24 OMNI TRACK ANGLE TO settings of the H-14A. **Note** Allow for the effect of omitting receiver phase shifts from measurements (refer to paragraph 5–8).	Same as with BTK-15F.	IN-10 vertical pointer centers for each ANGLE TO track, flag is out of sight, and to-from meter indicates TO.
5	Set H-14A MODULATION switch to 30~.	Same as with BTK-15F.	Vertical pointer flag fully visible.
6	Set H-14A MODULATION switch to 9960~.	Same as with BTK-15F.	Vertical pointer flag fully visible.
7	Set H-14A MODULATION switch to OMNI.	Same as with BTK-15F.	Vertical pointer flag completely out of sight.
	CONVERTER LOCALIZER CIRCUITS		
1	Perform Steps 1 through 4 of the preliminary procedure outlined in this table.	Same as with BTK-15F.	None.
2	Connect Ballantine Model 300 vtvm between NAV MOD V. and G test points of receiver test harness. Set receiver test harness NAV MOD SOURCE switch to EXTERNAL. Connect DEMOD output of ARC Type H-14A Signal Generator to receiver test harness EXT NAV MOD connector. Set control unit channel selector switches to 110.90 mc and H-14A crystal selector switch, MC, to A (110.90 mc). Set H-14A MODULATION switch to 30~ and adjust DEMOD output level to obtain a NAV MOD V. reading of 1.8 volts on the vtvm.	Same as with BTK-15F, except connect Ballantine Model 300 vtvm between J2 and J5 of test panel.	None.
3	Set H-14A MODULATION switch to AMP LOC (pointer center).	Same as with BTK-15F.	IN-10 vertical pointer centers. Vertical pointer flag out of sight. (If a 1-ma, 1000-ohm meter is used to replace the flag movement, its reading should be greater than 0.25 ma for a "pointer center" position.)
4	Set H-14A MODULATION switch to AMP LOC (pointer left).	Same as with BTK-15F.	IN-10 vertical pointer swings left to outer edge of blue sector. Vertical pointer flag out of sight. (This condition corresponds to 90 μa in meter movement. A 1000-ohm, 200-0-200 microammeter may be substituted for the IN-10 cross-pointer meter section, if desired.)

TABLE 5–3. TYPE 15F PERFORMANCE CHECKS — Continued

Step	Procedure With BTK-15F	Procedure Without BTK-15F	Normal Indications
	CONVERTER LOCALIZER CIRCUITS — Continued		
5	Set H-14A MODULATION switch to AMP LOC (pointer right).	Same as with BTK-15F.	IN-10 vertical pointer swings right to outer edge of yellow sector within about one pointer width (meter currents should be 90 ± 5 μa). Vertical pointer flag out of sight.
6	Set H-14A MODULATION switch to 90~.	Same as with BTK-15F.	Vertical pointer flag fully visible.
7	Set H-14A MODULATION switch to 150~.	Same as with BTK-15F.	Vertical pointer flag fully visible.
8	Set H-14A MODULATION switch to AMP LOC (pointer center).	Same as with BTK-15F.	Vertical pointer flag completely out of sight.

5–6. TROUBLE ANALYSIS.

General. Equipment trouble-shooting requires a systematic method of localizing the trouble, first to the unit in which the malfunction exists, then to a particular stage or to a functionally related group of stages, and finally to the defective part or parts. Equipment trouble-shooting, based on the normal operating procedure, will often help to determine which unit is at fault. An effective stage-by-stage test can then be made by signal tracing to isolate the faulty stage; sensitivity testing can also help to identify the stage. When the trouble has been traced to a particular stage, the faulty part or group of parts may be isolated and identified by a detailed trouble-shooting procedure which may include tube testing, voltage and resistance measurements (see Figures 5–28 and 5–29), and finally, repair or replacement of the defective part.

Trouble-shooting Charts. Tables 5–4 and 5–5 list the symptoms of some possible troubles, their probable causes, and the analysis procedures that should be used to verify each probable cause. The tables pertain to the R-34A Receiver and the B-13A-1 Converter, respectively. Use of the tables will help to localize the source of trouble, following which a point-by-point analysis may be made to determine the faulty part. To assist further in localizing trouble, reference should be made to the circuit theory discussion in Section IV and to the schematic diagrams in Section VI.

TABLE 5–4. R-34A RECEIVER TROUBLE-SHOOTING CHART

Symptom	Probable Cause	Analysis Procedure
	TUNING	
Tuner drive motor fails to run. Relays A3K1 and A3K2 operate normally. LV+ present at motor terminals.	Defective motor A3B1.	Remove gearing assembly from tuner assembly as outlined in paragraph 5–4, and check operation of motor by applying LV to its terminals.
	Improper seating of mechanical parts on tuner assembly.	Separate tuner and r-f/i-f assemblies as outlined in paragraph 5–4. Inspect for damaged or excessively tight parts. Check operation of parts on each assembly (refer to Table 5–3). Reassemble receiver as outlined in paragraph 5–4.
Tuner motor runs and drive-pawl lever operates normally but crystal drum does not rotate.	Improper seating or loading of mechanical parts on tuner or r-f/a-f assembly, or latching spring improperly seated on relay armature.	Separate r-f/i-f, i-f/a-f, and tuner assemblies as outlined in paragraph 5–4. Inspect for damaged or excessively tight parts. Check operation of parts on each assembly (refer to Table 5–3). Reassemble receiver as outlined in paragraph 5–4.
Receiver cycles to incorrect frequency (fractional mc or whole mc). May stop cycling between normal crystal drum stops.	Applicable latching lever improperly adjusted.	Check for correct overlap of latching lever on latching pin when the drive cam is in maximum-throw position (refer to paragraph 5–7).
	Applicable index-lock arm not functioning.	Check loading spring of index-lock arm. The arm should be spring-loaded to its "home" position.

TABLE 5–4. R-34A RECEIVER TROUBLE-SHOOTING CHART — Continued

Symptom	Probable Cause	Analysis Procedure
TUNING — Continued		
Receiver cycles continuously on some frequencies; normally on others.	Contact on crystal drum top plate or control unit selector switch, or an interconnecting wire between plate and switch shorted to ground.	Determine which crystal drum (fractional mc or whole mc) is rotating continuously. Use an ohmmeter to check the binary code switching sequence of defective switching circuit.
Receiver channels correctly on fewer than half of the frequencies selected.	Open contact on crystal drum top plate or control unit selector switch, or a broken interconnecting wire between plate and switch.	Determine which crystal drum (fractional mc or whole mc) is at fault. Use an ohmmeter to check the binary code switching sequence of defective switching circuit.
NAVIGATION OUTPUT		
IN-10 Course Indicator inoperative during localizer reception; localizer can be heard and identified. VOR operation normal.	Localizer Micro Switch A1S1 improperly aligned or defective, or an open circuit between the center terminal of A1S1 and control unit.	Check alignment of switch as described in *Tracking Adjustments* of paragraph 5–7. If alignment is normal, set channel selector switches at 108.10 mc and check for LV+ on center terminal of switch. If voltage is not present, replace switch. If voltage is present, check control unit switch S1B for open contacts (see Figure 6–14).
	Converter trouble.	Refer to Table 5–5.
Vertical pointer indications are erroneous during VOR and localizer reception. Amount of error is proportional to the distance of the receiver from the transmitter.	30-cps modulation on agc or regulated 100-volt dc lines.	Use oscilloscope to check for presence of 30-cps modulation on agc line. If modulation is greater than 0.4 volt, check C9, C15, and CR2. Check for presence of 30-cps modulation on regulated 100-volt line. If modulation is greater than 1.0 volt, check C34 or C37.
Receiver operates intermittently on one or more channels. Rechanneling may correct operation.	Misaligned crystal contacts.	Remove receiver cover. Tune to an intermittent channel and manually rock the crystal drums. If intermittent operation is produced, check alignment of applicable crystal contacts (see Figure 5–27).
COMMUNICATION OUTPUT		
Very weak or no audio output; IN-10 operates normally.	Improper squelch circuit connection.	Check remote squelch control for correct resistance value and proper connections. Check for correct wiring of pins E, F, and S of jack A1J2 (see Figure 6–1).
	Defective audio stage.	Make voltage and resistance measurements of audio stages (see Figure 5–28).
First syllable(s) of voice signals is garbled or completely missing.	Diode CR2 defective, producing slow squelch awakening.	Check forward and back resistance of diode. Forward resistance should be less than 1000 ohms. Back resistance should be at least 10,000 times the front resistance.
Receiver is not muted while channeling.	Defective muting diode CR5.	Check forward and back resistance of diode. Forward resistance should be less than 1000 ohms. Back resistance should be at least 10,000 times the front resistance.
Squelch operation sluggish. Audio output excessively loud and distorted.	High squelch reference voltage and excessive agc delay.	Check for normal agc delay (5 μv). If abnormal, check Zener diode CR4.
No squelch operation. Audio output distorted and excessively loud. Over-all receiver gain very low.	Agc and squelch reference voltage low or completely missing.	Check for +68 volts at junction of CR4 and R37 (see Figure 6–1). If voltage is very low or zero, check CR4 and R37. If voltage is normal, check R15 and R45.

TABLE 5–4. R-34A RECEIVER TROUBLE-SHOOTING CHART — Continued

Symptom	Probable Cause	Analysis Procedure
	COMMUNICATION OUTPUT — Continued	
Receiver is noisy when vibrated or tapped.	Microphonic circuit(s) caused by defective tube or loose solder joint.	Start at front end of receiver and trace the signal through each stage, disabling the stage immediately preceding the point of signal injection.
No audio output. Accessories connected to receiver work normally; plate of output tube V7 glows bright red; power supply filter parts overheating.	+100-volt regulated d-c line shorted to ground.	Check Zener diode CR6 and capacitors A2C34, A1C13, and A1C31 for shorts.
Receiver operates intermittently on one or more channels. Rechanneling may correct operation.	Misaligned crystal contacts.	Remove receiver cover. Tune to an intermittent channel and manually rock the crystal drums. If intermittent operation is produced, check alignment of applicable crystal contacts (see Figure 5–27).

TABLE 5–5. B-13A-1 CONVERTER TROUBLE-SHOOTING CHART

Symptom	Probable Cause	Analysis Procedure
IN-10 settings are not accurate.	Defective IN-10.	Substitute a "standard" IN-10 for the IN-10 under test. If the trouble is corrected, the original IN-10 is defective. If the trouble remains after substitution, refer to the next probable cause.
	Improper phase shift in reference phase or variable phase converter circuits.	Apply a 40-μv 30%-modulation omni signal to the R34A Receiver. Adjust the IN-10 for an on-course (pointer centered) indication. Check flag current; it should be equal to or greater than 230 μa. Check alignment of converter VOR circuits (refer to paragraph 5–8). If normal, use an oscilloscope and electronic switch to compare the phase relationship of the 30-cps voltage and the a-f input signal at the points specified in Figure 6–12. If all converter circuits operate normally, check the R-34A (refer to Table 5–4).
Vertical pointer flag is not "hard down" when in range of a VOR or localizer transmitter.	Defective R-34A Receiver.	Check the performance of the converter as outlined in Table 5–3. If normal, trouble shoot the R-34A. If abnormal, check contacts of relay K202 in the converter. The contact resistance should be approximately 0.1 ohm. **Caution** Disconnect the IN-10 before checking the contact resistance.
IN-10 inoperative during localizer reception. Indicator operates normally during VOR reception.	Relay K201 (14-volt models). Relay K201 or K202 (28-volt models).	Set control unit channel selector switches to several localizer frequencies. Check relays K201 and K202 at each localizer frequency. They should be energized. If relays energize on some frequencies but not on others, check the fractional megacycle channel selector switch on the control unit. If relays do not energize check the relays, the R-34A localizer switch A1S1, and the control unit fractional megacycle channel selector switch.
	Detail part in 90/150 cps amplifier.	Check operation of relays K201 and K202 as described in the preceding analysis procedure. If normal, check tube V206 and make detailed voltage and resistance checks of the 90/150-cps amplifier circuits (see Figure 5–29).

TABLE 5–5. B-13A-1 CONVERTER TROUBLE-SHOOTING CHART — Continued

Symptom	Probable Cause	Analysis Procedure
To-from meter inoperative. All other IN-10 indications normal.	Detail part in to-from meter circuit.	Check CR205, CR206, C235, R235, R236, and R253.
	IN-10 to-from meter.	Substitute a "standard" IN-10 for the IN-10 under test. If the substitution corrects the trouble, check the original IN-10 for electrical and mechanical defects.

5–7. ADJUSTMENT AND ALIGNMENT OF R-34A RECEIVER.

General. The following paragraphs describe the alignment and adjustment procedures for the R-34A Receiver. The test equipment required for the procedures is listed in Table 5–1. The bench test setup using an ARC Type BTK-15F Bench Test Kit is shown in Figure 5–24. Figure 5–25 illustrates the bench test setup without the BTK-15F. The standard test conditions described in paragraph 5–5 are applicable when using either bench test setup.

Make the following tests and adjustments before aligning the R-34A Receiver.

Step 1. Interconnect the test equipment and the Type 15F units as shown in Figure 5–24 or 5–25.

Step 2. Apply power to the equipment and allow a 5-minute warmup period.

Step 3. With a Simpson Model 260 Multimeter (1000-volt dc range) connected between the receiver test harness HV+ and G test points (J1 and J2 of the test panel in Figure 5–25), adjust the primary voltage to produce a reading of 240 volts.

Tuner Assembly Adjustments. Normally, adjustment of the tuner assembly should not be necessary; however, if it is definitely determined that readjustment is required, proceed as follows:

Step 1. To adjust the latching relay position, turn the equipment off, remove the receiver top cover, and rotate the gearing assembly drive cam to maximum-throw position (see Figure 5–16). Remove the two screws holding each guard in place (see Figure 5–26). Adjust the relay mounting screws and relay locking setscrews so that the latch overlaps the latching pin by at least 0.020 inch and clears the pin by at least 0.015 inch when the relay is unenergized. When the relay is energized, the latch must disengage the latching pin with at least 0.015-inch clearance on the back stroke.

Step 2. To adjust the driving stroke, loosen the drive-pawl pivot screw, and using the slotted end of the drive-pawl lever, adjust the pawl position so that with the relay energized and the drive cam near maximum throw, the indexing pin drops into the slot in the index plate at each drum position. When the drive cam is in minimum-throw position, the drive pawl must retract sufficiently to engage the following ratchet tooth of the drive ratchet plate at each drum position.

Tracking Adjustments. Normally, adjustment of the r-f and i-f tracking circuits will not be necessary; however, if mechanical parts in the tuning linkage have been changed, their alignment should be checked before proceeding with electrical tests. Due to the pawl action, the crystal drums turn in one direction only. The megacycle crystal drum and associated cams start at 108 mc, ascend in even-megacycle steps to 126 mc, pass through the blank position to 125 mc, then descend in odd-megacycle steps to 109 mc, completing the cycle. See Figure 5–27 and perform the following procedure to adjust the tracking circuits:

Step 1. Turn the equipment off, and remove the receiver top cover and bottom and side plates. Set the receiver megacycle crystal drum to the blank space between 126 and 125 mc. The hole located on the maximum radius of the heart-shaped cam should be directly over the shaft of A1C28. If the hole is not properly aligned, loosen the No. 4 splined-drive setscrew that attaches the crystal drum to the cam driving shaft, and rotate the cam into proper alignment. The setscrew is accessible through a hole in the crystal drum at the blank space. Tighten the setscrew.

Step 2. Check the operation of audio level switch A1S2. As the megacycle crystal drum is rotated, the associated lever should close switch A1S2 halfway between 119 and 117 on the crystal drum, and open the switch halfway between 116 and 118.

Step 3. If the switch does not operate properly, set the megacycle drum to 119, loosen the mounting screws holding the switch, move the switch until its actuating button just touches the lever assembly, and tighten the mounting screws slightly.

Step 4. Check the operation of the switch. If properly positioned, it will operate as described in Step 2. If the switch operation is normal, tighten the mounting screws. If the switch does not actuate properly, repeat Step 3.

Step 5. Check the operation of localizer switch A1S1. As the megacycle crystal drum is rotated, the associated

lever should close switch A1S1 halfway between 113 and 111 on the crystal drum, and open the switch halfway between 110 and 112.

Step 6. If the switch does not operate properly, set the megacycle drum to 113, loosen the mounting screws holding the switch, move the switch until its actuating button just touches the lever assembly, and tighten the mounting screws slightly.

Step 7. Check the operation of the switch. If properly positioned, it will operate as described in Step 5. If the operation of the switch is normal, tighten the mounting screws. If the switch does not actuate properly, repeat Step 6.

Step 8. Check the alignment of the fractional megacycle crystal drum gear and its associated driven gear. Remove the button plug, located below the SQUELCH control on the receiver front panel. Turn the fractional megacycle crystal drum until the two recessed setscrews, located at right angles to each other in the shoulder of the driven gear, are accessible (one through the hole in the front panel and the other through the cut-out in the right side of assembly A1).

Step 9. The crystal drum should now be in the .00-mc position. If not, proceed as follows: Loosen the tuner assembly and the two setscrews, unmesh the driven and crystal drum gears, turn the crystal drum to .00 mc, and remesh the gears. Tighten the tuner assembly, but do not tighten the setscrews.

Step 10. Turn the slotted driven-gear shaft until maximum coil-slug penetration is reached. Tighten the two setscrews.

Step 11. Check the gain of the 1.7-mc i-f amplifiers (refer to Table 5–6).

Variable I-f Filter Alignment. No realignment of the i-f filters should be made unless the over-all gain of the receiver is unsatisfactory and no other cause can be determined. If alignment of the variable i-f filter becomes necessary, proceed as follows:

Step 1. Connect the bench test setup as shown in Figure 5–24 or 5–25.

Step 2. Remove the receiver top cover and bottom plate. Connect the d-c probe of the Hewlett-Packard Model 410B Voltmeter to the junction of A2R22 and A2R26, and the ground lead to the receiver chassis (see Figure 6–1). Set the vtvm to the −10-volt dc range.

Step 3. Connect the Measurements Model 65-B Signal Generator to pin 1 of A1V4.

Step 4. Apply power to the equipment and allow a 5-minute warmup period.

Step 5. Set the control unit fractional megacycle channel selector switch to .00 mc. Tune the signal generator for a peak reading on the voltmeter at approximately 11.7 mc, and mark the setting of the signal generator dial with an A.

Step 6. Set the control unit fractional megacycle channel selector switch to .90 mc. Tune the signal generator for a peak reading on the voltmeter at approximately 12.6 mc, and mark the setting of the signal generator dial with a B.

Note

In the following steps, maintain a voltmeter reading of less than −4 volts to avoid agc action.

Step 7. Remove the receiver side plate. Connect the signal generator output to pin 1 of A1V3. Set the control unit fractional megacycle channel selector switch to .00, and tune the signal generator to position A. Adjust trimmers A1C15 and A1C21, accessible through holes on the top bearing plate, for a maximum voltmeter reading.

Step 8. Set the control unit fractional megacycle channel selector switch to .90 mc, and tune the signal generator to position B. Adjust slug-tuned inductors A1L5 and A1L6 for a maximum voltmeter indication by rotating each inductor slug clockwise or counterclockwise, using a small capstan wrench or lever.

Step 9. Repeat Steps 7 and 8 until further adjustment of inductor slugs produces negligible improvements in output, as indicated on the voltmeter. The inductance adjustment should always be the final adjustment.

Step 10. Measure the 11.7-mc i-f signal (refer to Table 5–6).

Megacycle Oscillator-Doubler Alignment. Align the megacycle oscillator-doubler stage as follows:

Step 1. Connect the bench test setup as shown in Figure 5–24 or 5–25.

Step 2. Remove the receiver top cover and bottom plate. Set the control unit megacycle channel selector switch to 126 mc. Connect the ground lead and the r-f probe of the Hewlett-Packard Model 410B Voltmeter to ground and the junction of pins 2 and 8 of A1V3, respectively (see Figure 6–1). A1V3 is accessible through a large hole provided in the side plate. Set the voltmeter range at 3 volts ac.

Step 3. Apply power to the equipment and allow a 5-minute warmup period.

Step 4. Loosen the two setscrews in the tuning arm of A1C28 (see Figure 5–27) with a No. 4 spline wrench. Rotate the capacitor shaft using the screwdriver slot until the capacitor blades are approximately seven-eighths of the way open (additional counterclockwise shaft rotation should reduce the meshed area when the blades are properly set). Tighten the setscrews.

Step 5. If necessary, separate the r-f/i-f and i-f/a-f assemblies (refer to paragraph 5–4). Adjust trimmer capacitor A1C29, accessible through a hole in the rear panel of the r-f/i-f assembly, for a maximum voltmeter reading.

Step 6. Use a tuning wand to check doubler coil A1L10 for a peak voltmeter reading. If placing the iron tip near the coil increases the reading, move the turns of A1L10 closer together. If placing the brass tip near the coil increases the reading, spread the turns of A1L10. A maximum voltmeter reading should be obtained when the wand is held away from the coil.

Step 7. Set the control unit megacycle channel selector switch to 108 mc. Recheck A1L10 with the tuning wand. If necessary, turn the A1C28 tuning arm adjustment screw to obtain a peak reading when the wand is removed.

Step 8. Check A1L7 with the tuning wand. If necessary, adjust coil turn spacing as described for A1L10 in Step 6.

Step 9. Repeat Steps 5, 6, and 7 until no further improvement in output occurs.

Step 10. Check the r-f output for every megacycle channel. The voltmeter should read 0.7 volt (minimum) for each channel.

R-f Alignment. Complete r-f realignment will be necessary if major parts, such as tuning capacitors, tuning arms, etc., have been replaced. Generally, only replacement of a tube will require the adjustment of its tuned input and output circuits. No adjustment of the coils or tuning capacitors should be made unless the stage gain is unsatisfactory and no other cause can be determined. If alignment becomes necessary, proceed as follows:

Step 1. Connect the bench test setup as shown in Figure 5–24 or 5–25.

Step 2. Apply power equipment and allow a 5-minute warmup period.

Step 3. Set the channel selector switches on the control unit to 126.50 mc. Remove the receiver top cover and bottom plate. Remove the 10 screws holding the receiver side plate. Use a No. 4 spline wrench to loosen the two setscrews in the tuning arm of A1C4 (see Figure 5–27). Adjust the capacitor rotor, using the screwdriver slot in the end of the capacitor shaft, so that the capacitor blades are approximately seven-eighths of the way open (additional counterclockwise shaft rotation should reduce the meshed area when the blades are properly set). Tighten the setscrews.

Step 4. Loosen the two setscrews in the tuning arm of cascode-grid tuning-capacitor A1C1. Rotate the shaft until the capacitor is at its approximate minimum-capacity position. Tighten the setscrews.

Step 5. Connect the d-c probe of the Hewlett-Packard Model 410B Voltmeter to the junction of A2R22 and A2R26, and the ground lead to the receiver chassis (see Figure 6–1). Set the vtvm to the −10-volt dc range.

Step 6. Connect the output of the Boonton Radio Model 211-A Signal Generator through the Boonton Radio Model 505-B 6-db Attenuator to the ANT jack, J1, on the R-34A front panel.

Step 7. Tune the signal generator through 126.50 mc, as indicated by a maximum reading on the voltmeter. At first, a relatively large signal generator output voltage may be required to obtain a tuning indication. Adjust trimmer capacitors A1C5A and A1C5B with a low-capacity alignment tool for a peak voltmeter reading.

Note

When making final alignment adjustments, always adjust the signal generator output level to maintain a reading of −4 volts or less on the voltmeter.

Step 8. Turn the power off and temporarily connect a 20-μμf capacitor from the stator of trimmer capacitor A1C5B to ground. Turn the power on, and with the signal generator still tuned to 126.50 mc, readjust trimmer capacitor A1C5A for a peak reading on the voltmeter. Check antenna coil A1L1 with the tuning wand for optimum peaking. If adjustment is required, loosen the two setscrews in the tuning arm of A1C1, adjust the capacitor rotor as required to obtain a maximum reading, and tighten the setscrews.

Step 9. Set the control unit channel selector switches to 108.50 mc, and tune the signal generator for a maximum voltmeter reading at 108.50 mc. Use the tuning wand to check plate coil A1L3 for optimum tuning. If adjustment is required, carefully tune A1C4 of A1L3 to obtain maximum output. Check A1L1 with the tuning wand for optimum peaking. If adjustment is required, tune A1C1 by means of its tuning arm adjustment screw.

Step 10. Set the control unit channel selector switches to 126.50 mc. Turn the power off, remove the 20-μμf capacitor connected in Step 8, and connect the capacitor from the stator of A1C5A to ground. Turn the power on, and tune the signal generator for a maximum voltmeter reading at 126.50 mc. Adjust A1C5B for a peak voltmeter reading.

Step 11. Set the control unit channel selector switches to 108.50 mc. Tune the signal generator for a peak voltmeter reading at 108.50 mc. Check A1L4 with the tuning wand. If adjustment is required, tune A1L4 to obtain maximum output. Repeat Step 10. Turn the equipment off, and remove the 20-μμf capacitor connected in Step 10.

Step 12. Replace the receiver side plate. Set the control unit channel selector switches to 126.50 mc, and tune the signal generator for a maximum voltmeter reading at 126.50 mc. Adjust A1C5B through the access hole in the side plate for peak output.

Step 13. Adjust i-f sensitivity control A1R17 to approximately 80 per cent of full clockwise travel.

Step 14. Adjust the signal generator for a 108.50-mc r-f output modulated 30 per cent by a 1000-cps audio signal. Set the attenuator dial to 2 MICROVOLTS.

Step 15. Set the control unit to 108.50 mc, and connect the Ballantine Model 300 Voltmeter between A2J4 and ground. Adjust the OFF-VOL control on the control unit for a 14-db (0.5 volt) indication on the voltmeter.

Step 16. Record the receiver output obtained when the signal generator and the control unit are set to the following frequencies: 108.00, 108.90, 113.00, 113.50, 113.90, 117.00, 117.50, and 117.90 mc. The output at each frequency should be 14 $\pm$ 6 db.

Step 17. Set the signal generator and the control unit to 118.00 mc. The receiver output should drop approximately 9 db from the level recorded in Step 16.

Step 18. Adjust OFF-VOL control on the control unit for a 14-db indication on the voltmeter.

Step 19. Record the receiver output obtained when the signal generator and the control unit are set to the following frequencies: 118.00, 118.90, 122.00, 122.50, 122.90, 126.00, 126.50, and 126.90 mc. The output at each frequency should be 14 $\pm$ 6 db.

Receiver Navigation Output Level. Align the navigation output stage as follows:

Step 1. Connect the bench test setup as shown in Figure 5–24 or 5–25.

Step 2. Apply power to the equipment and allow a 5-minute warmup period.

Step 3. Remove the receiver top cover and bottom plate. Connect the Ballantine Model 300 Voltmeter between pin 5 of A2J4 and the receiver chassis (see Figure 6–1). Set the control unit channel selector switches and the ARC Type H-14A Signal Generator to 114.90 mc. Set the H-14A MODULATION switch at 30~, and adjust the 30~ MOD switch for 30 per cent modulation. Set the ATTENUATOR control to 100 μv. Connect the RF OUTPUT ATTEN jack through the 6-db attenuator to the ANT jack of the R-34A.

Step 4. The voltmeter should read between 1.8 and 2.1 volts. If necessary, change the value of A2R45 (connected to one end of A1R15) to obtain the correct voltage. The resistor should be between 50K and 470K ohms.

Step 5. Check the receiver output at 30 per cent modulation of 9960-cps modulation signals. The output should not vary more than $\pm$1.5 db from the 30-cps value obtained in Step 4.

Step 6. Set the control unit and the H-14A to 110.90 mc. Adjust the H-14A 90~ MOD and 150~ MOD controls for 20 per cent modulation, set the MODULATION switch to AMP LOC ↓ (pointer center), and set the ATTENUATOR control to 100 μv. The voltmeter should read 1.8 $\pm$ 0.2 volts.

Step 7. Set the H-14A MODULATION switch to 90. The voltmeter should read 1.4 $\pm$ 0.2 volts. Set the MODULATION switch to 150. The voltmeter should read 1.4 $\pm$ 0.2 volts.

Receiver Phase Shift. The 30-cps phase shift of the receiver has been accurately determined and adjusted at the factory to be 192° over-all. Replacement of C16, C17, C18, C19, R13, R14, R44, T3, or V4 in the i-f/a-f assembly may change the phase shift, in which case the receiver should be readjusted at the factory. If the receiver cannot be returned to the factory, an over-all check of its course accuracy may be performed by using the H-14A Signal Generator as follows:

Note

Be certain that the converter is operating properly when performing the following steps.

Step 1. If A2R44 has to be changed for any reason, remove the receiver top cover and replace R44 with a 200K-ohm resistor (see Figure 6–1). Connect the H-14A through a 6-db attenuator to the R-34A ANT jack. Adjust the H-14A for a 114.9-mc, 0° ANGLE "TO," OMNI modulation signal. Set the H-14A ATTENUATOR control to 100 μv.

Step 2. Set the IN-10 Course Indicator to exactly 0°. If the vertical pointer is deflected completely out of the 3/16-inch diameter black circle, adjust the value of A2R44 to bring the pointer to an on-course indication. The resistor used should be between 47K and 470K ohms. If the pointer is off course but still inside the black circle, converter control R225 may be adjusted for an on-course indication.

Step 3. Slowly increase the H-14A ATTENUATOR setting to 10,000 μv, then decrease it to 10 μv. The pointer should not leave the black circle. Any erratic reading may be due to defective electrolytic capacitors A2C29, A2C15, or A2C34, which should be replaced with capacitors having a minimum of the rated capacitance value. If diode A2CR1 or A2CR2 is defective, erratic reading may also result.

TABLE 5–6. R-34A STAGE GAIN MEASUREMENTS

Conditions:

1. Channel selector switches set to 126.00 mc.
2. Channel selector switches set to 108.00 mc.
3. The 1.7-mc and 11.7-mc signals are supplied by Measurements Model 65-B Signal Generator, or equivalent, terminated with Boonton Radio Model 505-B 6-db Attenuator. Output of attenuator is direct-coupled between input point and chassis ground.
4. Input shown for r-f and i-f signals is the signal level required to obtain −4.0 volts dc between the junction of A2R22 and A2R26 and chassis ground. Hewlett-Packard Model 410B Voltmeter, or equivalent, used for measurements.
5. The 108.00-mc and 126.00-mc r-f signals are supplied by Boonton Radio Type 211-A Signal Generator, or equivalent, terminated with Boonton Radio Model 505-B 6-db Attenuator. Output of attenuator is direct-coupled between input point and chassis ground.
6. I-f sensitivity control R17 on receiver front panel set to maximum clockwise rotation.
7. Receiver SQUELCH circuit disabled for all tests.
8. R-f and i-f input levels, except input to J1 ANT, may vary between half and twice the nominal value listed.
9. Audio voltages measured with Ballantine Model 300 Voltmeter, or equivalent. Readings may vary 20 per cent.
10. Audio voltages are taken with 100-μv input to J1 ANT, 1000-cps modulation, C-81A VOL control at maximum clockwise position, and TEL line terminated in 300 ohms. All readings are in rms volts. Audio gain may also be checked by applying 1000 cps from an audio oscillator to junction of A2R22 and A2R26.

Tube	Signal Input		Conditions
	Pin No.	μV	
1.7-MC I-F MEASUREMENTS			
A2V3 (fourth i-f)	1	400,000	3, 4, 6, 7, 8
A2V2 (third i-f)	1	22,000	3, 4, 6, 7, 8
A2V1 (second i-f)	1	1,400	3, 4, 6, 7, 8
A1V5 (first i-f)	1	160	3, 4, 6, 7, 8
11.7-MC I-F MEASUREMENTS			
A1V4 (second mixer)	1	60	3, 4, 6, 7, 8
A1V3 (first mixer)	1	10	3, 4, 6, 7, 8
126.00-MC R-F MEASUREMENTS			
A1V3 (first mixer)	1	12	1, 4, 5, 6, 7, 8
A1V1, A1V2 (r-f ampl)	J1 ANT	2.1	1, 4, 5, 6, 7

AUDIO MEASUREMENTS

Per Cent Mod	Junction A2R22 & A2R26	Pins 7, 8 A2V6	Pin 5 A2V6	Pin 7 A2V5	Pin 1 A2V7	TEL Output	Conditions
30	2.0	0.82	0.75	0.1	2.5	7	1, 6, 7, 9, 10
85	5.0	2.6	2.0	0.45	7.5	15	1, 6, 7, 9, 10
30	2.0	0.82	0.75	0.1	6.5	14	2, 6, 7, 9, 10

5–8. ADJUSTMENT AND ALIGNMENT OF B-13A-1 CONVERTER.

General. The following paragraphs describe the alignment and adjustment procedures for the B-13A-1 Converter. The test equipment required for the procedures is listed in Table 5–1. The bench test setup using an ARC Type BTK-15F Bench Test Kit is shown in Figure 5–24. Figure 5–25 illustrates the bench test setup without a BTK-15F. The standard test conditions described in paragraph 5–5 are applicable.

Effects of Removing Receiver Phase Shift During Alignment of Converter. The phase of the 30-cps navigation output from the R-34A leads the phase of the input modulation envelope by 192° when the receiver navigation output line is open-circuited. This phase shift is carefully adjusted during manufacture and must be considered whenever the converter is tested or aligned as a separate unit.

When the B-13A-1 Converter is fed directly from the DEMOD output of the ARC Type H-14A Signal Generator during course accuracy checks, on-course indications should be obtained when the reading on the IN-10 is 192° greater than the ANGLE "TO" setting of the H-14A OMNI TRACK switch; that is, for an omni track of 0°, an on-course indication should correspond to an IN-10 reading of 192° TO; for a 300° track, an on-course indication should be obtained at 132° (492° – 360°); and similarly for other courses. The reason for this difference is that the open-circuit phase of the H-14A DEMOD output is 192° behind the corresponding R-34A output phase. Therefore, the course indicator must be rotated to advance the phase by 192° in the B-13A-1. A perfect B-13A-1 should produce on-course indications on the cross-pointer meter of the IN-10 whenever the TO reading of the to-from meter is 192° greater than the setting of the H-14A OMNI TRACK switch, or when the FROM reading of the to-from meter is 12° greater.

Preliminary Procedure. Make the following tests and adjustments before aligning the receiver:

Step 1. Interconnect the test equipment and the Type 15F units as shown in Figure 5–24 or 5–25.

Step 2. Apply power to the equipment and allow a 15-minute warmup period.

Step 3. With a Simpson Model 260 Multimeter (1000-volt dc range) connected between the receiver test harness HV+ and G test points (J1 and J2 of the test panel in Figure 5–25), adjust the primary voltage to obtain an HV+ reading of 240 volts.

Step 4. Connect the H-14A DEMOD ouput to the EXT NAV MOD connector of the receiver test harness (between test panel jacks J2 and J4 in Figure 5–25). With the Ballantine Model 300 connected between the converter test harness NAV MOD V. and G test points (J5 and J2, respectively, of Figure 5–25), and with the NAV MOD SOURCE switch (S1 of Figure 5–25) set to EXTERNAL, adjust the H-14A Signal Generator for "level set" indications of the r-f level and the individual 30-cps and 9960-cps modulations as outlined in the H-14A instruction book. With the H-14A MODULATION switch set to 30~, adjust the signal generator DEMOD output to obtain a NAV MOD V. reading of 1.8 volts. Set the MODULATION switch to OMNI.

Step 5. Turn converter control R226 to the extreme counterclockwise position and set R225 and R239 approximately at mid position.

Note

It is assumed that prior to alignment all electron tubes have been tested. Defective tubes should be replaced and good tubes returned to their original sockets.

Adjustment of VOR Variable Channel Circuits. Connect the Ballantine Model 300 vtvm between B-13A-1 test jacks J202 and J203. With the H-14A Signal Generator MODULATION switch set to OMNI, adjust the variable channel output voltage to approximately 4 volts, using converter VAR LEVEL control R250.

Adjustment of VOR Reference Channel and Phase Comparison Circuits.

Step 1. With the H-14A Signal Generator MODULATION switch set to OMNI, make a preliminary adjustment of converter BAL potentiometer R239 to obtain an on-course indication on the IN-10 (zero meter current).

Step 2. Set the signal generator OMNI TRACK switch to 0°, and the IN-10 Course Indicator to 191.5°.

Step 3. Connect the Ballantine Model 300 between test jacks J201 and J202 (see Figure 6–12), and adjust converter REF LEVEL potentiometer R226 to obtain a reading of approximately 4 volts.

Step 4. Adjust converter PHASE potentiometer R225 for an on-course indication on the IN-10.

Step 5. Set the signal generator OMNI TRACK switch to 180°. The IN-10 vertical pointer should remain centered (on course); if not, readjust BAL potentiometer R239 to reduce the off-center error by one-half.

Step 6. Repeat the adjustments of R225 at a 0° OMNI TRACK setting and of R239 at a 180° OMNI TRACK setting (Steps 3, 4, and 5 of this procedure) until an on-course indication is obtained for both tracks. Lock R239, taking care not to disturb its setting.

Adjustment of VOR Course Sensitivity.

Step 1. Set the H-14A OMNI TRACK switch at 0°, and set the IN-10 to 181.5°. The IN-10 vertical pointer should indicate a "5-dot" deflection to the right (yellow) side, which corresponds to 150 μa. If necessary, adjust REF LEVEL control R226 to obtain this deflection. Reset PHASE control R225 for an on-course indication with the IN-10 set to 191.5°. Repeat the procedure if necessary.

Step 2. Reduce the 30-cps modulation and the 9960-cps modulation levels to 15 per cent. Adjust VOR FLAG potentiometer R268 until the flag just begins to show (230 μa of flag current).

Step 3. Measure the reference channel output voltage with the Ballantine Model 300 connected between test jacks J201 and J202. If it is not within 0.5 volt of the variable channel output, adjust the VAR LEVEL potentiometer, R250, to produce the required balancing of these outputs.

Note

As the variable channel output (J202 and J203) is raised, the reference channel output (J202 and J201) must be decreased (and vice versa) to maintain the proper off-course deflection of 10°. Therefore, the "5-dot" deflection for 10° off course must be rechecked whenever the setting of either R226 or R250 is changed. If R250 was readjusted in this step, repeat Steps 4 and 5 of the reference channel and phase comparison circuit adjustment, and then lock R239, R226, R225, and R250.

Check of VOR Reference Channel Limiter and Other Circuits. Connect a Ballantine Model 300 between pin 7 of V203A and chassis ground. After the reference channel and phase comparison circuit adjustment and the course-sensitivity adjustment have been completed, a reading within the limits of 0.9 and 1.1 volts should be obtained if the reference channel circuits beyond this test point are functioning properly. Also, if the limiter and the 10-kc amplifier, V201A, are functioning properly, the voltage as read on the vtvm between pin 4 of V201A and chassis ground should be within the limits of 2.8 and 3.4 volts. If either or both of these voltages are out of limits, it is an indication of trouble (refer to Table 5–5).

Adjustment of Phase Splitter Network to Minimize Quadrantal Errors.

Caution

Do not attempt this critical adjustment unless R222 has been damaged, or R221 or C210 has been replaced, or the presence of excessive quadrantal error has been positively determined experimentally.

Step 1. Set the H-14A Signal Generator OMNI TRACK control to 30°, and adjust the IN-10 for an on-course indication of the vertical pointer. The IN-10 should read very close to 222° (30° + 191.5°). If it does not, subtract 222° from the actual reading and record the difference with the proper algebraic sign.

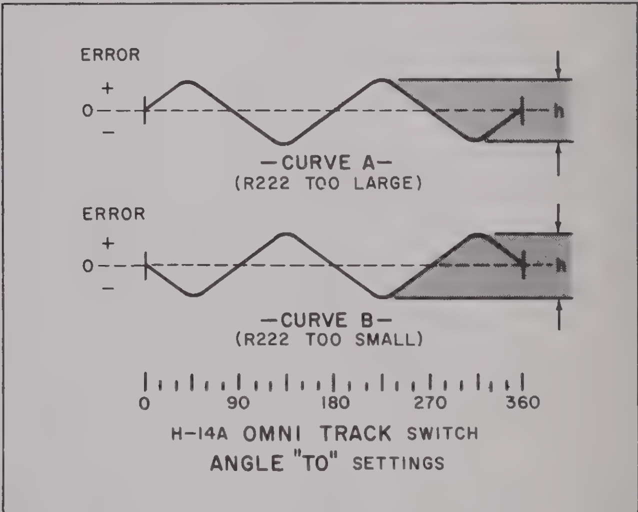
Step 2. Set the signal generator OMNI TRACK control to 60°. Readjust the IN-10 to approximately 252° for an on-course vertical pointer indication, and again record the difference.

Step 3. Repeat the measurements of Step 2 for each successive 30° angle (that is, 90°, 120°, 150°, etc.) around the OMNI TRACK switch, recording the errors of indication as in the previous steps.

Step 4. Plot a curve of errors as calculated (in degrees) against the setting of the OMNI TRACK switch. If the value of R222 is not optimum, an average curve similar to one of the following curves will result. In an ideal curve of this type, the peak-to-peak distance "h" will be zero.

Note

Small random errors will cause the observed points to scatter around such an average curve. Attempt to average out these errors when plotting the curve.



Step 5. If the peak-to-peak distance "h" is not close to zero, reduce "h" to a minimum as follows: If the plotted curve is similar to curve A of the illustration, decrease R222 by an amount equal to "h" (in degrees) x 10,000 ohms; if the plotted curve is similar to curve B, increase R222 by an amount equal to "h" (in degrees) x 10,000 ohms.

Step 6. After changing R222 by the amount calculated in Step 5, plot a new quadrantal error curve (Steps 1 through 4) to confirm the resultant value of R222.

Step 7. When the quadrantal error curve has been made as nearly a straight line as possible, set the signal

generator OMNI TRACK switch to 90° and set the IN-10 to 282°.

Step 8. Unlock R225 and adjust it for an on-course vertical pointer indication, or as required to give minimum error averaged around the compass. Lock R225, taking care not to disturb its setting.

Adjustment of VOR Flag Circuit.

Step 1. Set the H-14A Signal Generator individual 30-cps and 9960-cps modulation percentages at 15 per cent. Set the MODULATION switch to OMNI.

Step 2. Adjust B-13A-1 VOR FLAG potentiometer R268 until the IN-10 vertical pointer flag just begins to show (230 μa of flag current). Lock R268, taking care not to disturb its setting.

Step 3. Set the H-14A individual 30-cps and 9960-cps modulation percentages at 30 per cent. The IN-10 vertical pointer flag should be completely out of sight (flag current greater than 250 μa).

Over-all Performance Check. Check for course accuracy around the full circle, and for flag and to-from meter operation as described in Table 5–3.

Adjustment of Localizer Section.

Step 1. Set the control unit channel selector switches to 110.90 mc.

Step 2. Apply 1.8 volts of AMP LOC (pointer center) modulation from the H-14A Signal Generator DEMOD output to the receiver test harness EXT NAV MOD input (between J2 and J4 of the test panel in Figure 5–25).

Step 3. Set SENS potentiometer R257 at approximately a two-thirds clockwise position, and adjust BAL potentiometer R264 to obtain an on-course indication on the IN-10. (R257 and R264 are located on the front panel of the B-13A-1.)

Step 4. Set the signal generator MODULATION switch to AMP LOC (pointer left), and adjust R257 until the IN-10 vertical pointer lies at the outer edge of the blue sector on the IN-10 dial. (This position corresponds to 90 ± 5 μa. If desired, a 1000-ohm, 200-0-200 microammeter may be used in place of the IN-10 cross-pointer meter section.)

Step 5. Set the signal generator to AMP LOC (pointer right). The vertical pointer should lie at the outer edge of the yellow sector, plus or minus approximately one pointer width. The equivalent meter current should be 90 ± 5 μa. If the pointer differs from the specified deflection, request R257 to reduce the difference by one-half. Lock R257 and R264, taking care not to disturb their settings.

Step 6. Set the signal generator MODULATION switch to 150~.

Step 7. Adjust LOC FLAG potentiometer R269 until the IN-10 vertical pointer flag is fully visible (175 μa of flag current). Lock R269, taking care not to disturb its setting.

Step 8. Adjust the 90~ MOD and 150~ MOD controls for 20 per cent modulation. The IN-10 vertical pointer flag should be completely out of sight (flag current greater than 250 μa).

Step 9. Check all the AMP LOC pointer settings of the signal generator. The on-course indication, at 0 ± 2 μa, should be accurate; the "pointer left" and "pointer right" positions, at 85–95 μa meter current each, should be short of the ends of their respective colored sections by about two pointer widths. Residual errors should be approximately balanced on both sides. In all settings, the flag should be completely out of sight.

5–9. MEASUREMENTS.

Typical voltage and resistance measurements for the R-34A Receiver and the B-13A-1 Converter are given in Figures 5–28 and 5–29. Typical stage gain measurements for the R-34A are listed in Table 5–6.

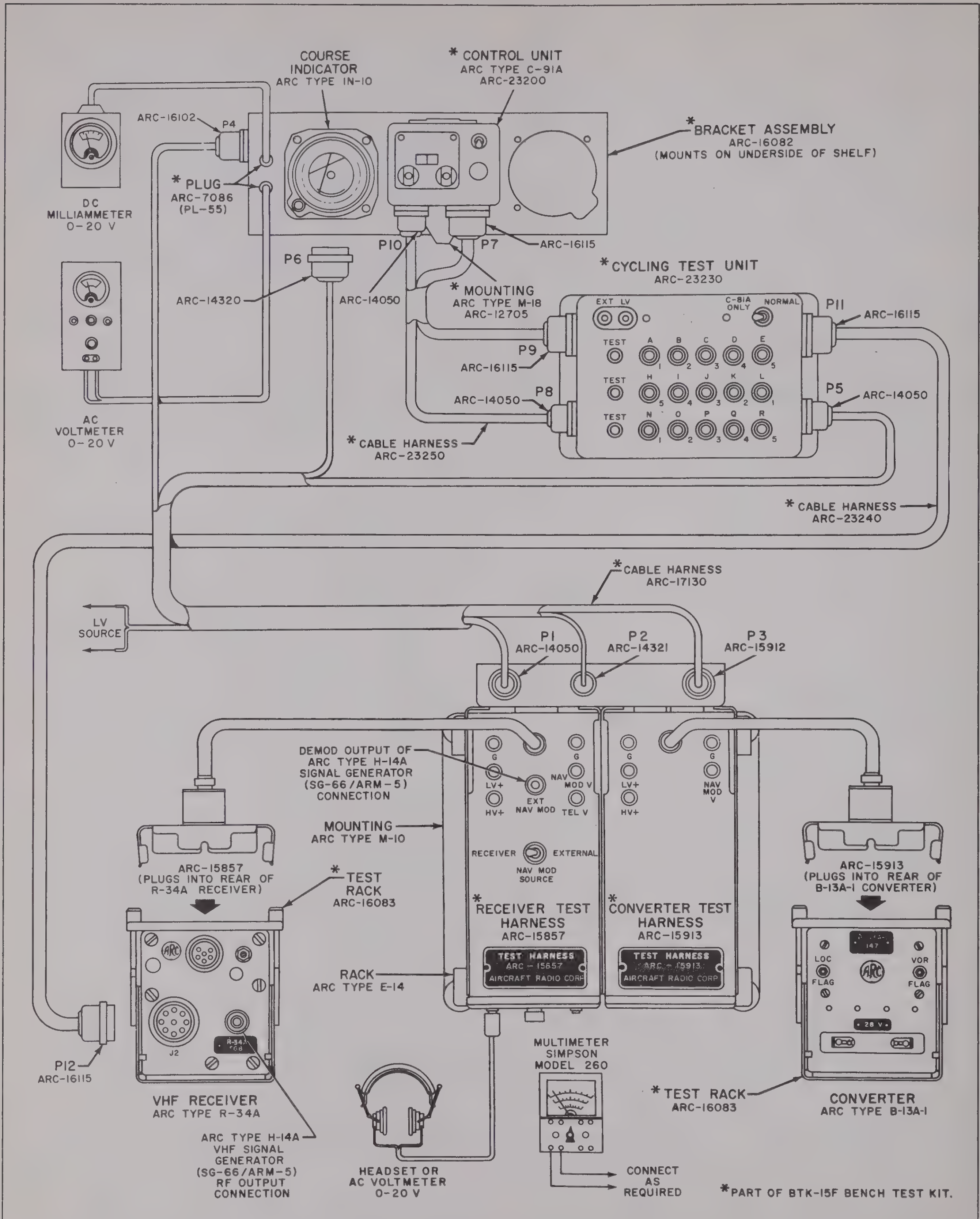


Figure 5–24. Bench Test Interconnection Diagram With ARC Type BTK-15F Bench Test Kit

NOTES:

1. WIRES ARE NO. 20 EXCEPT THOSE MA
WITH AN ASTERISK (*), WHICH ARE NO

2. WIRES INDICATED BY ⊐ SHOULD BE S
WITH BRAIDED CABLE.

3. CONNECTORS AND RECEPTACLES MA
WITH A DOUBLE ASTERISK (**) ARE PA
THE TEST PANEL.

4. REMOVE IN-10 FLAG CONNECTIONS (P
AND F) WHEN A METER IS USED TO M
FLAG CURRENT.

5. REMOVE IN-10 VERTICAL POINTER CO
TIONS (PINS A AND B) WHEN A METER
TO MEASURE VERTICAL POINTER CUR

TABLE I. ARC PART NUMBERS
FOR TEST PANEL

Ref Desig	ARC Part No.
J1	13152
J2	12921
J3	13152
J4	13152
J5	13152
J6	13152
J7	7565
J9	12921
J10	15834
J11	15834
P1	5488
P2	5488
R1	202-0301
R2	8882-0503
S1	3280

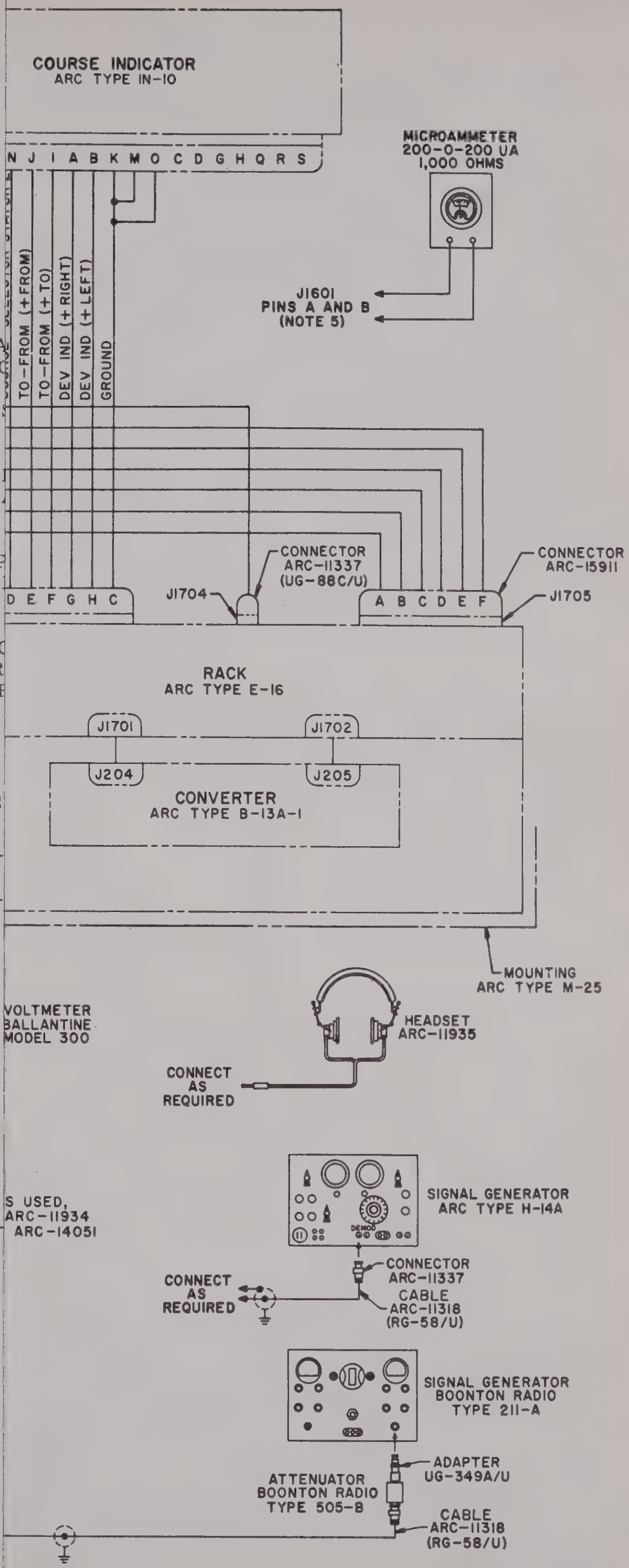


Figure 5–25. Bench Test Interconnection Diagram Without ARC Type BTK-15F Bench Test Kit

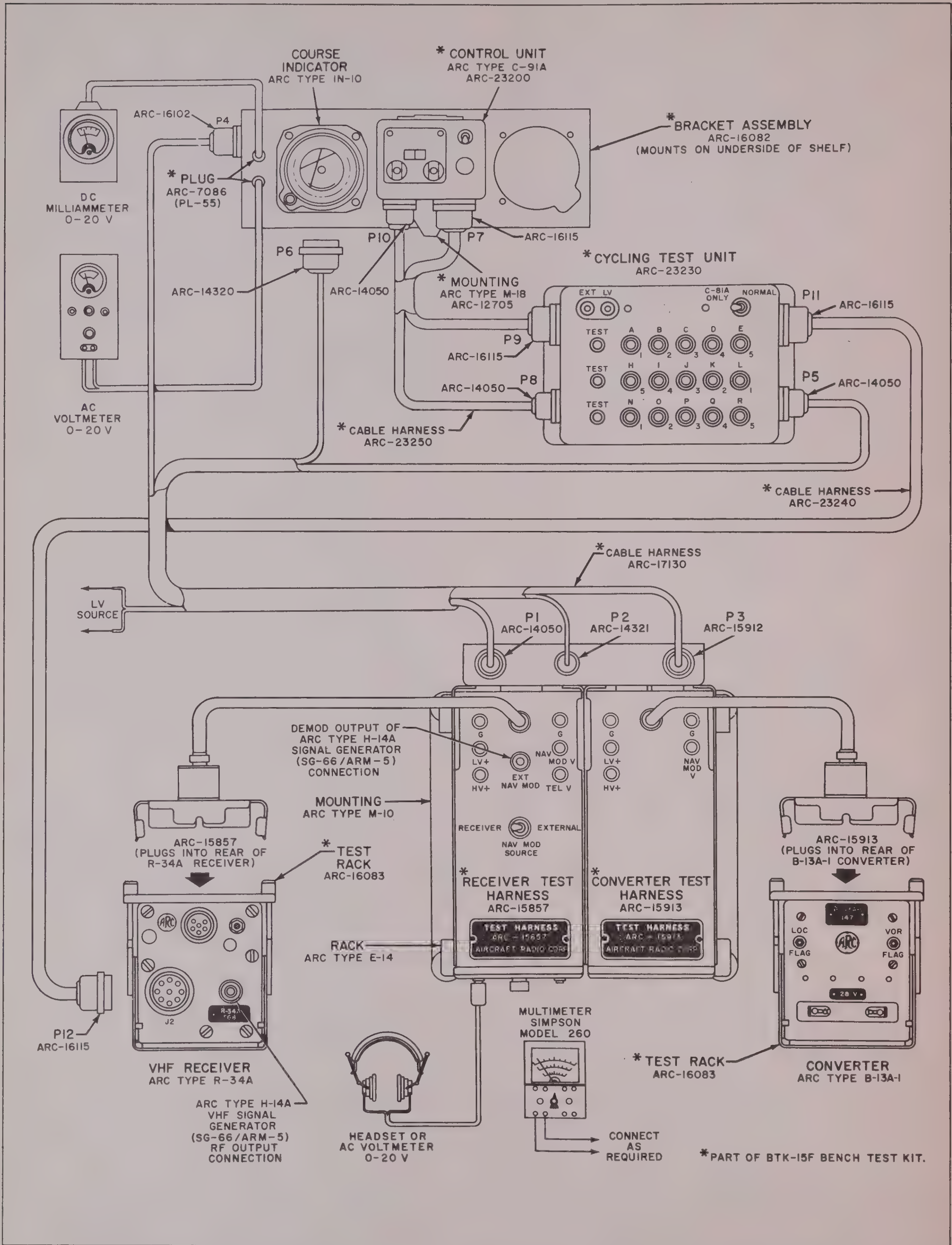


Figure 5–24. Bench Test Interconnection Diagram With ARC Type BTK-15F Bench Test Kit

NOTES:

1. WIRES ARE NO. 20 EXCEPT THOSE MARKED WITH AN ASTERISK (*), WHICH ARE NO. 16.
2. WIRES INDICATED BY ⊐ SHOULD BE SHIELDED WITH BRAIDED CABLE.
3. CONNECTORS AND RECEPTACLES MARKED WITH A DOUBLE ASTERISK (**) ARE PART OF THE TEST PANEL.
4. REMOVE IN-10 FLAG CONNECTIONS (PINS E AND F) WHEN A METER IS USED TO MEASURE FLAG CURRENT.
5. REMOVE IN-10 VERTICAL POINTER CONNECTIONS (PINS A AND B) WHEN A METER IS USED TO MEASURE VERTICAL POINTER CURRENT.

TABLE I. ARC PART NUMBERS FOR TEST PANEL

Ref Desig	ARC Part No.
J1	13152
J2	12921
J3	13152
J4	13152
J5	13152
J6	13152
J7	7565
J9	12921
J10	15834
J11	15834
P1	5488
P2	5488
R1	202-0301
R2	8882-0503
S1	3280

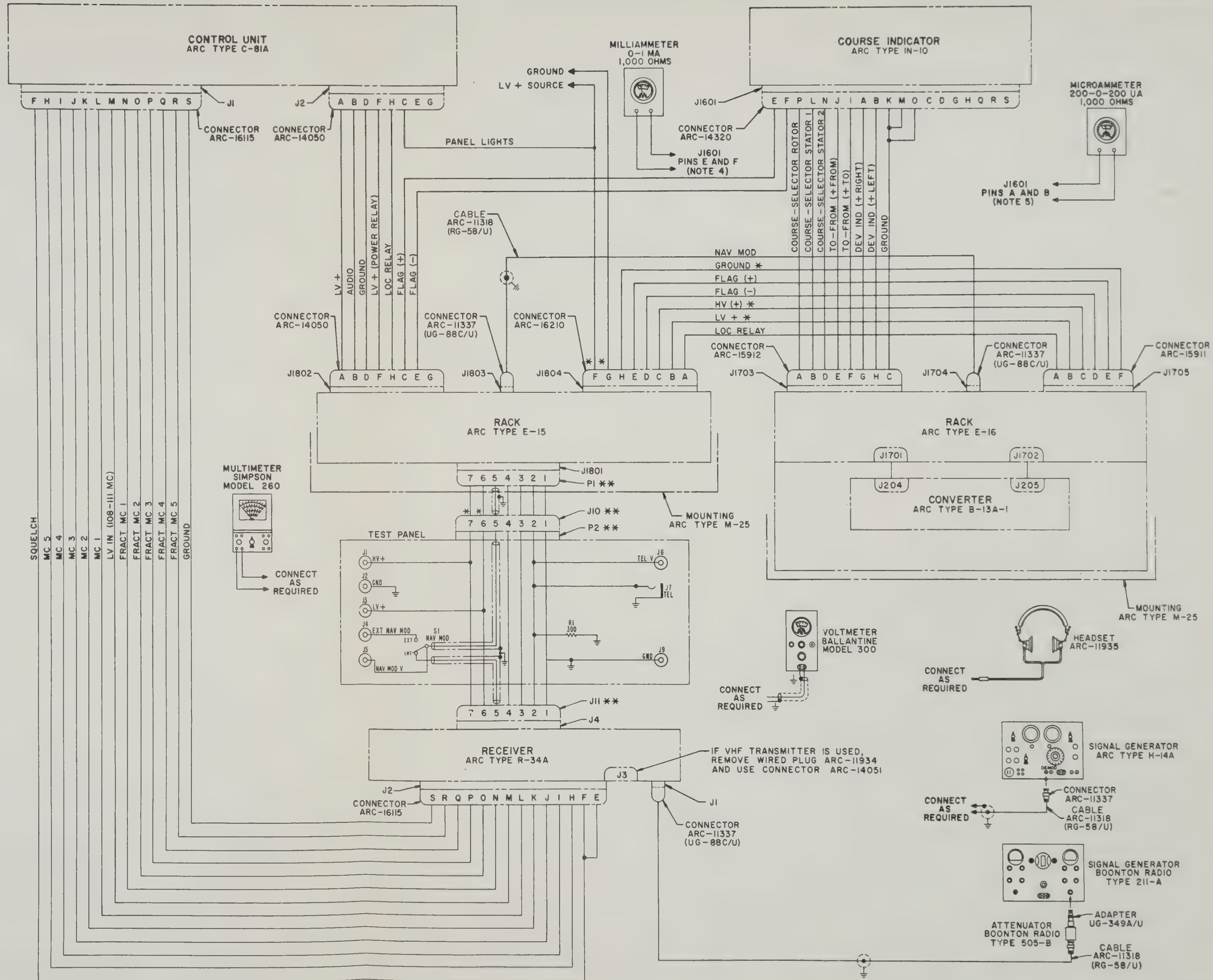


Figure 5–25. Bench Test Interconnection Diagram Without ARC Type BTK-15F Bench Test Kit

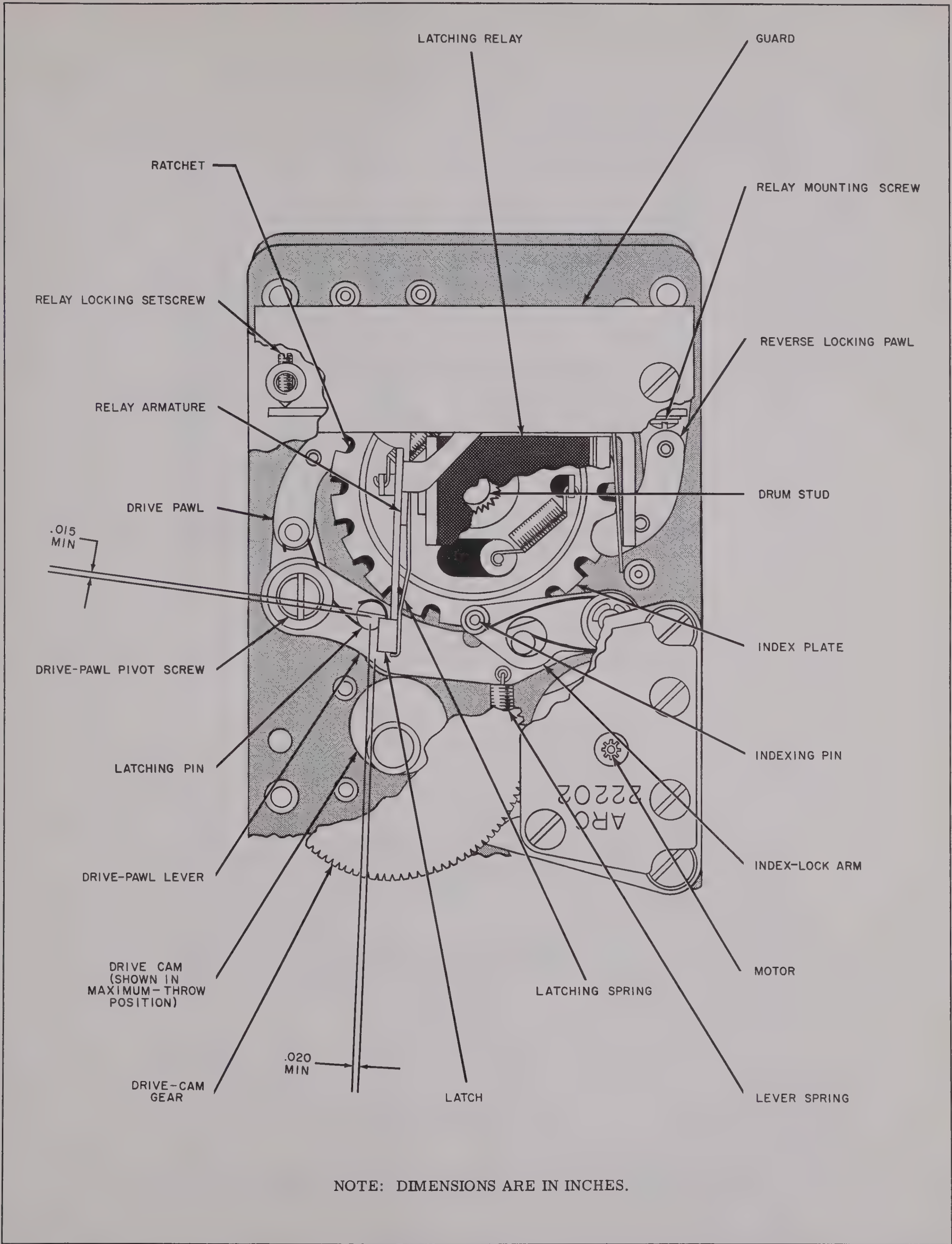


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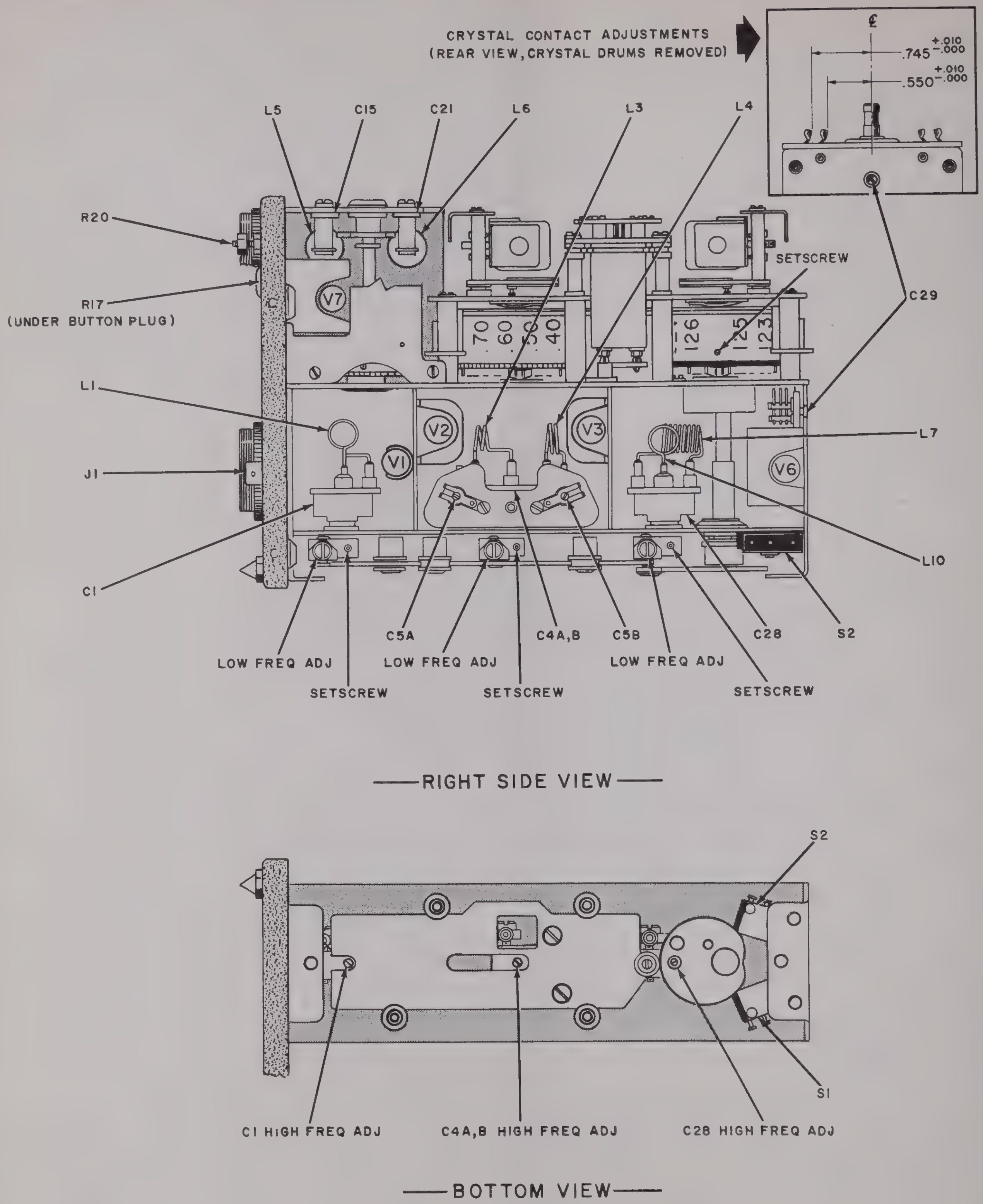
Figure 5–26. R-34A Receiver, Tuner Assembly Adjustment Points



NOTE: REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1; FOR EXAMPLE, A1C29.

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Figure 5–27. R-34A Receiver, R-f/I-f Assembly Adjustment Points

NOTES:

1. V R
2. R T M
3. V B
4. R A
5. S O
6. V C T
7. N
8. V 20
9. V T
10. V 5
11. F S
12. N

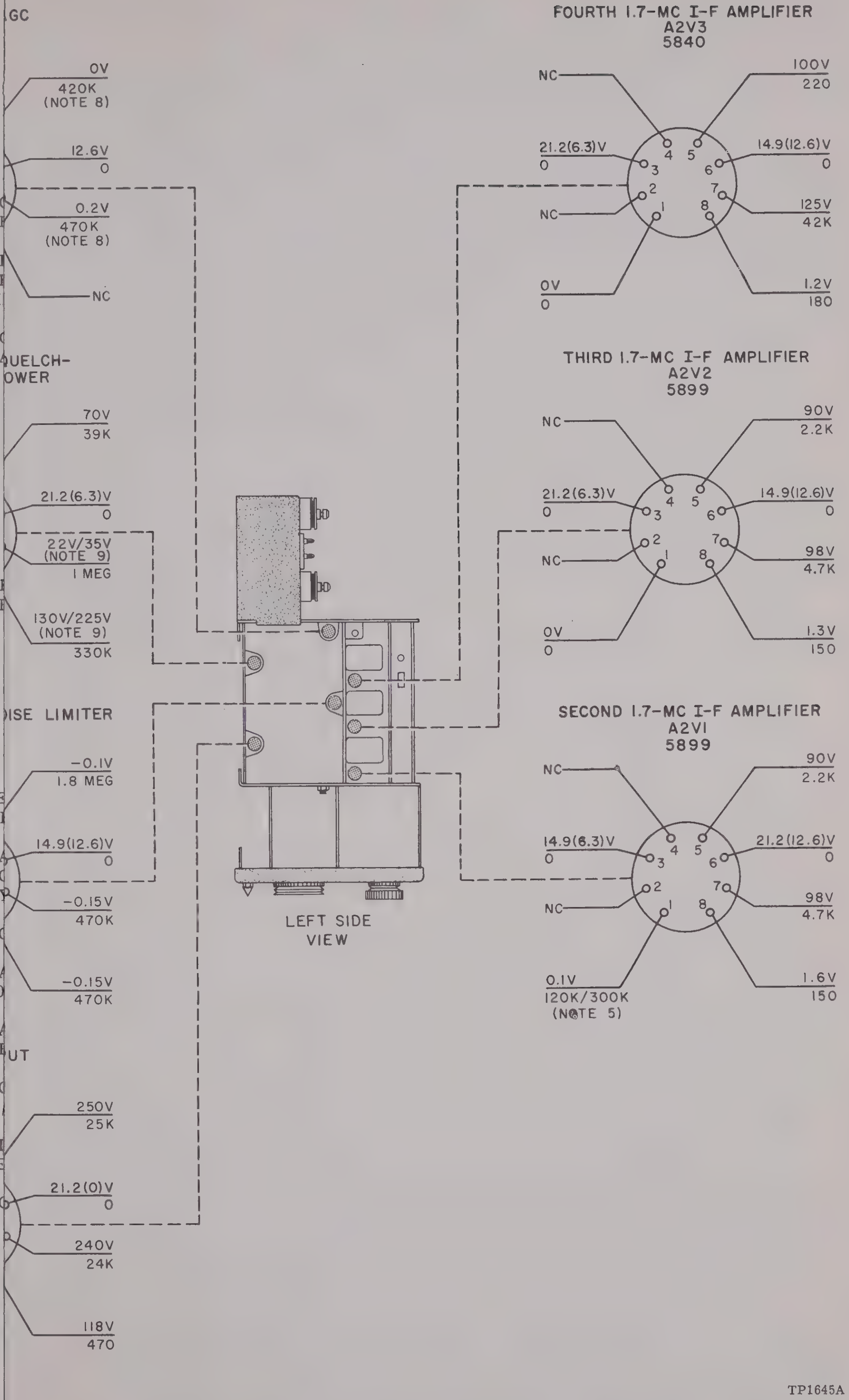
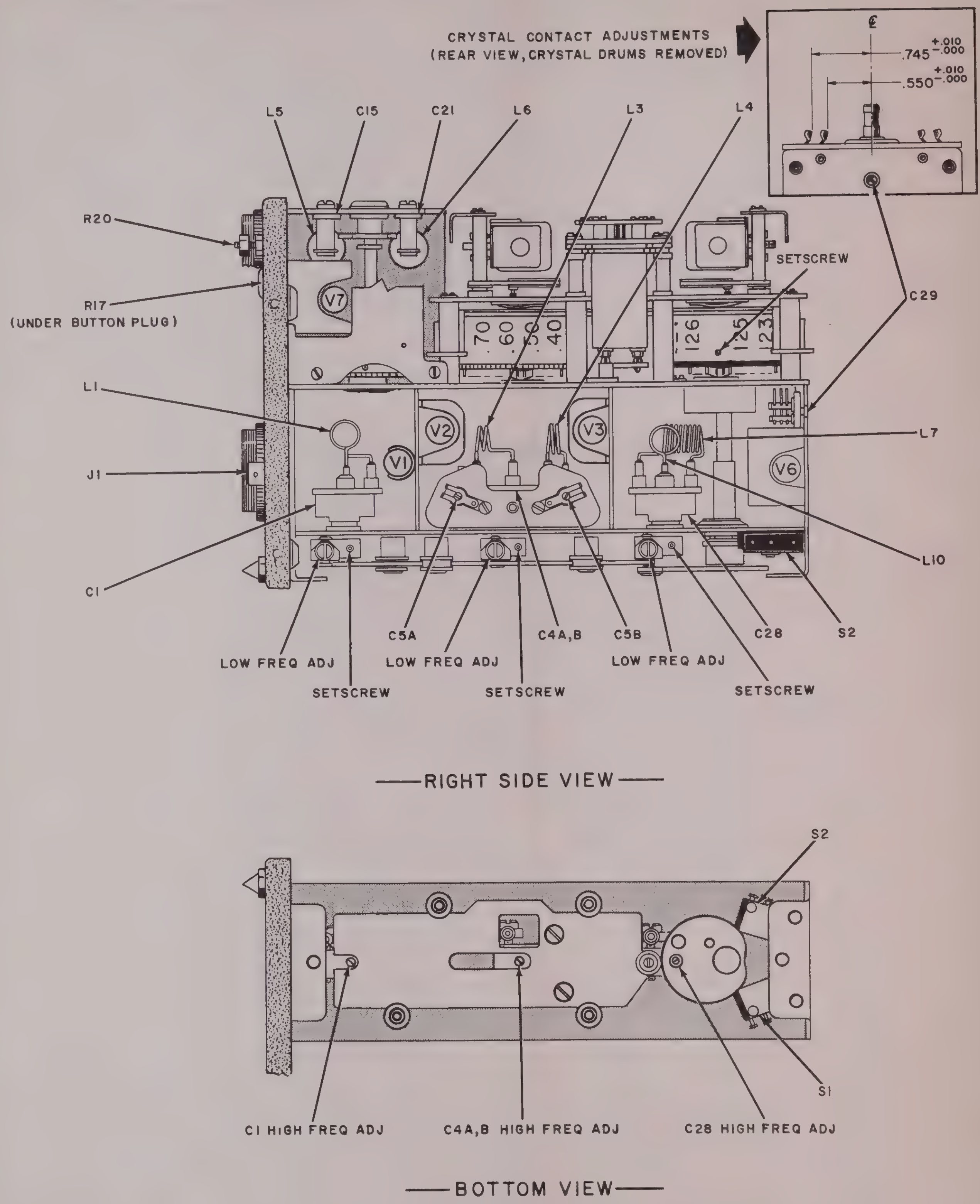


Figure 5–28. R-34A Receiver, Voltage and Resistance Diagram



NOTE: REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1; FOR EXAMPLE, A1C29.

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Figure 5–27. R-34A Receiver, R-f/I-f Assembly Adjustment Points

NOTES:

1. VOLTAGES ARE DC AND APPEAR ABOVE THE REFERENCE LINE.

2. RESISTANCES ARE IN OHMS AND APPEAR BELOW THE REFERENCE LINE. MULTIPLIERS K=1000, MEG=1,000,000.

3. VOLTAGE VALUES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS:
   (A) VALUES ARE WITH RESPECT TO CHASSIS GROUND.
   (B) 27.5 VOLTS DC MEASURED AT PIN 6 OF A2J4, EXCEPT HEATER VOLTAGES SHOWN IN PARENTHESES, WHICH ARE FOR 14-VOLT MODEL.
   (C) 20,000 OHMS-PER-VOLT VOLTMETER USED UNLESS OTHERWISE NOTED.
   (D) NO R-F SIGNAL INPUT UNLESS OTHERWISE NOTED.

4. RESISTANCE VALUES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS:
   (A) CABLES AND POWER SUPPLY DISCONNECTED FROM RECEIVER.
   (B) WIRED PLUG ARC-11934 IN J2 ON FRONT PANEL.
   (C) 100-VOLT SUPPLY GROUNDED. (CONNECT A1C13 TO GROUND.)
   (D) NEGATIVE TERMINAL OF OHMMETER GROUNDED UNLESS OTHERWISE NOTED.

5. SECOND VALUE TAKEN WITH POSITIVE TERMINAL OF OHMMETER GROUNDED.

6. VALUE DEPENDS ON SETTING OF I-F SENSITIVITY CONTROL A1R17. TYPICAL V READING—1.5V, TYPICAL R READING—1.5K.

7. NO SIGNIFICANT MEASUREMENT CAN BE MADE.

8. VALUE WILL DIFFER IF A2R44 IS OTHER THAN 200K OHMS.

9. VALUE DEPENDS ON SETTING OF SQUELCH CONTROL A1R20.

10. VOLTAGE IS -0.5 VOLT WITH R-F SIGNAL OVER 5 μV.

11. FIRST VALUE TAKEN FROM 108 TO 117 MC; SECOND FROM 118 TO 126 MC.

12. NC INDICATES NO CONNECTION.

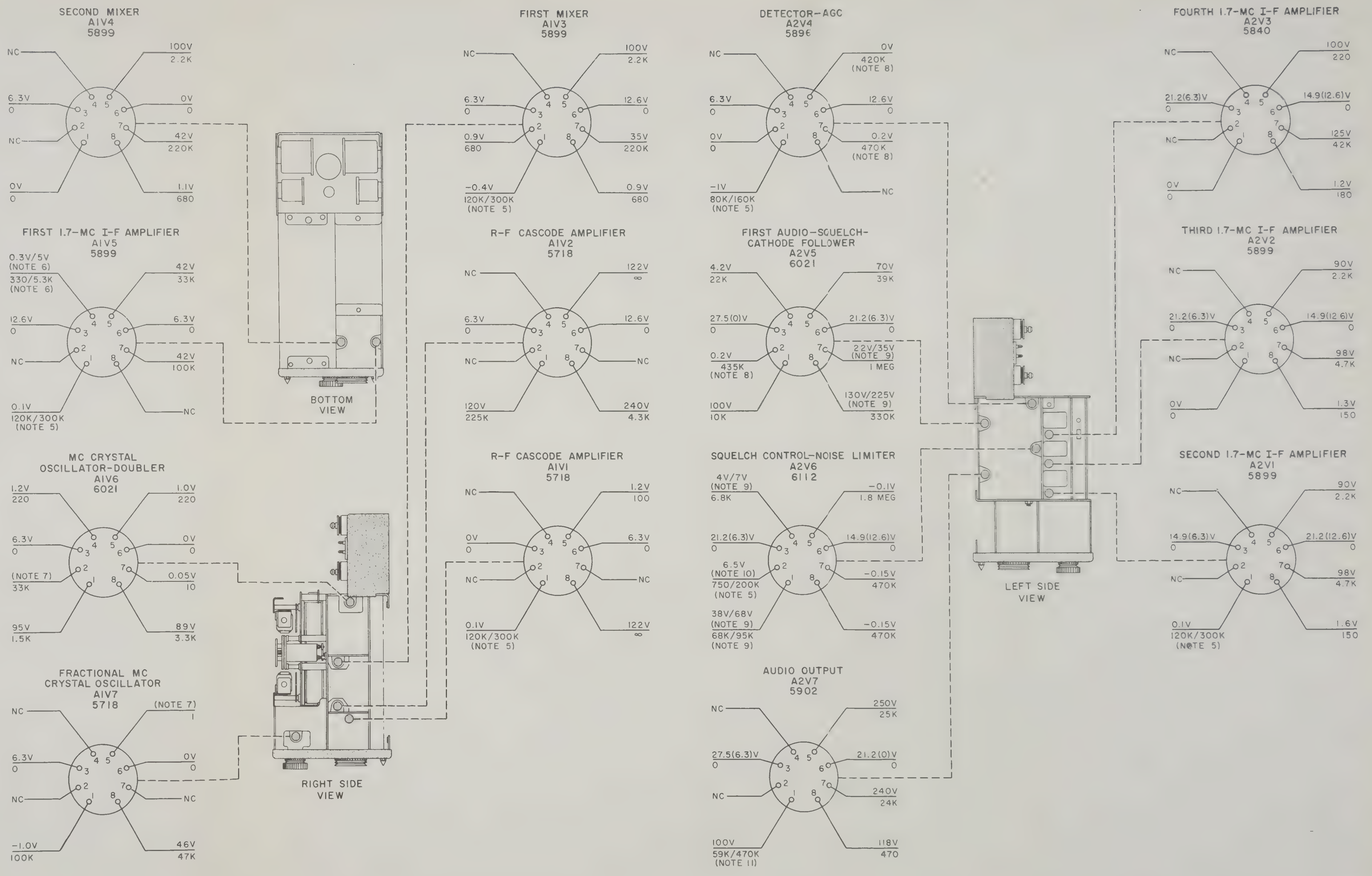

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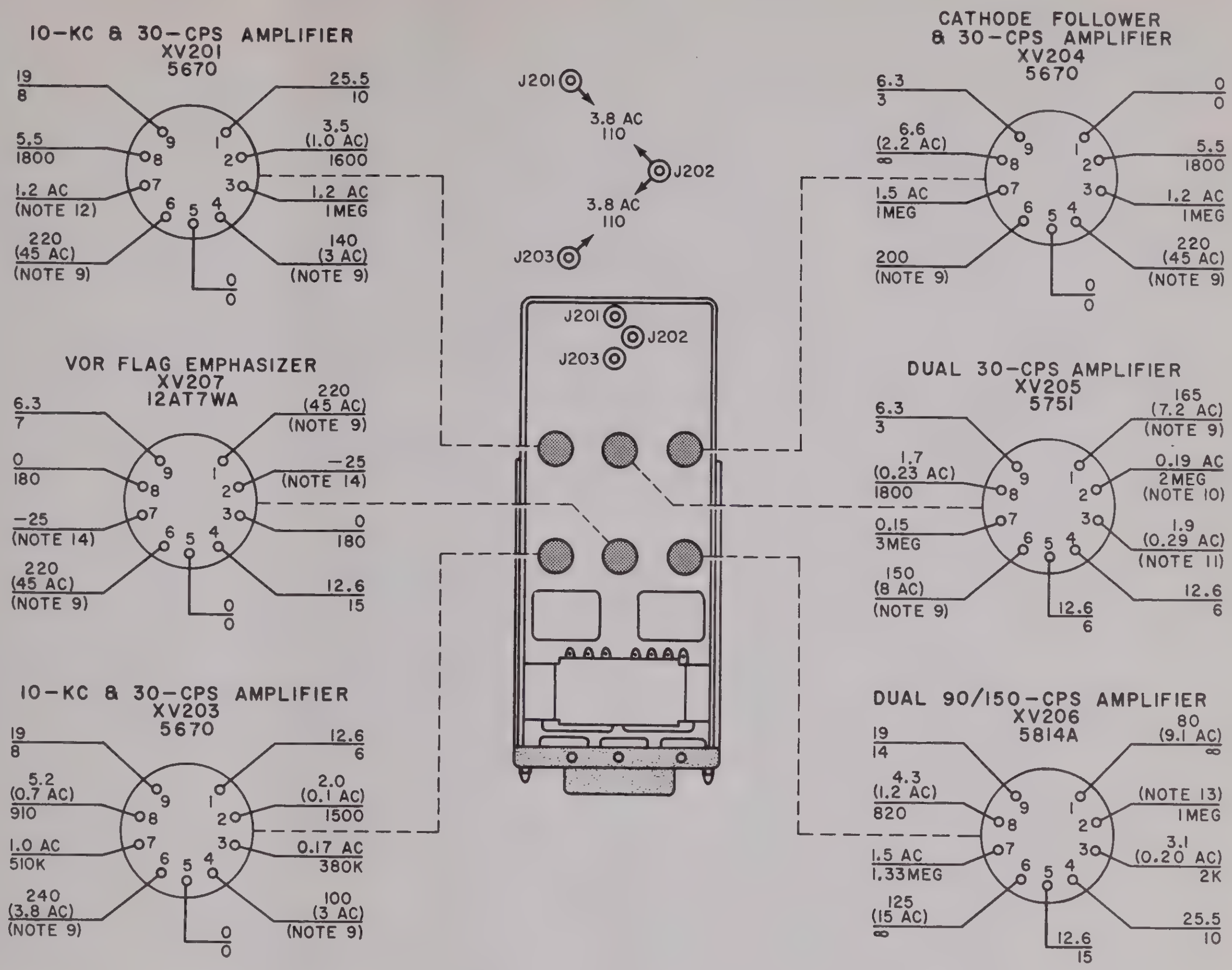
Figure 5–28. R-34A Receiver, Voltage and Resistance Diagram



NOTES:

1. VIEW IS OF BOTTOM OF CHASSIS.
2. VOLTAGES ARE DC, UNLESS OTHERWISE NOTED, AND APPEAR ABOVE THE REFERENCE LINE.
3. RESISTANCE VALUES ARE IN OHMS AND APPEAR BELOW THE REFERENCE LINE. MULTIPLIERS K=1000, MEG=1,000,000.
4. MEASUREMENTS ARE MADE WITH RESPECT TO GROUND, EXCEPT J201 AND J203, WHICH ARE MADE WITH RESPECT TO J202.
5. RESISTANCE MEASUREMENTS ARE MADE WITH B-13A-1 DISCONNECTED FROM SYSTEM.
6. VOLTAGE MEASUREMENTS ARE MADE WITH B-13A-1 CONNECTED IN SYSTEM AND WITH HIGH VOLTAGE SUPPLIED BY ARC TYPE DV-10A OR DV-11A DYNAVERTER INSTALLED ON RECEIVER.
7. D-C VOLTAGE MEASUREMENTS ARE MADE WITH 20,000 OHMS-PER-VOLT VOLTMETER, SUCH AS SIMPSON MODEL 260 OR WESTON MODEL 790, WITH LV+ SET AT THE NOMINAL SUPPLY VOLTAGE OF 14 OR 28 VOLTS. VOLTAGES ARE APPROXIMATE AND WILL BE SLIGHTLY HIGHER FOR 28-VOLT EQUIPMENT THAN FOR 14-VOLT EQUIPMENT.
8. A-C VOLTAGE MEASUREMENTS ARE MADE WITH BALLANTINE MODEL 300 VACUUM TUBE VOLTMETER, AND WITH "STANDARD" TEST SIGNAL LEVELS OF 1.8 VOLTS ±0.1 VOLT AT 30 CPS AND 1.8 VOLTS ±0.2 VOLT AT 9960 CPS. FILAMENT VOLTAGE MEASUREMENTS ARE MADE WITH 28-VOLT LV+ SUPPLY.
9. NO SIGNIFICANT MEASUREMENT DUE TO CAPACITOR CHARGING.
10. DEPENDS ON VALUE OF R222 AND SETTING OF R225.
11. DEPENDS ON VALUE (SETTING) OF R226.
12. DEPENDS ON VALUE (SETTING) OF R250.
13. NO SIGNIFICANT MEASUREMENT. 1.8 AC ON INPUT SIDE OF C236 WITH RELAY K201 ACTUATED.
14. RESISTANCE WILL DEPEND ON METER CONNECTIONS; SHOULD BE 1MEG OR 320K OHMS.

Figure 5–29. B-13A-1 Converter, Voltage and Resistance Diagram

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SECTION VI

DIAGRAMS

Referenc… Designati…
C1
C2
C3
C4
C5
C6
C7
C8
C9
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C11
C12
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C46
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C48
C49
C50
C51
C52
C53
C54
C55
C56
C57
C58
C59

[1]For 14-volt m…
[2]For 28-volt m…
[3]To complete p…

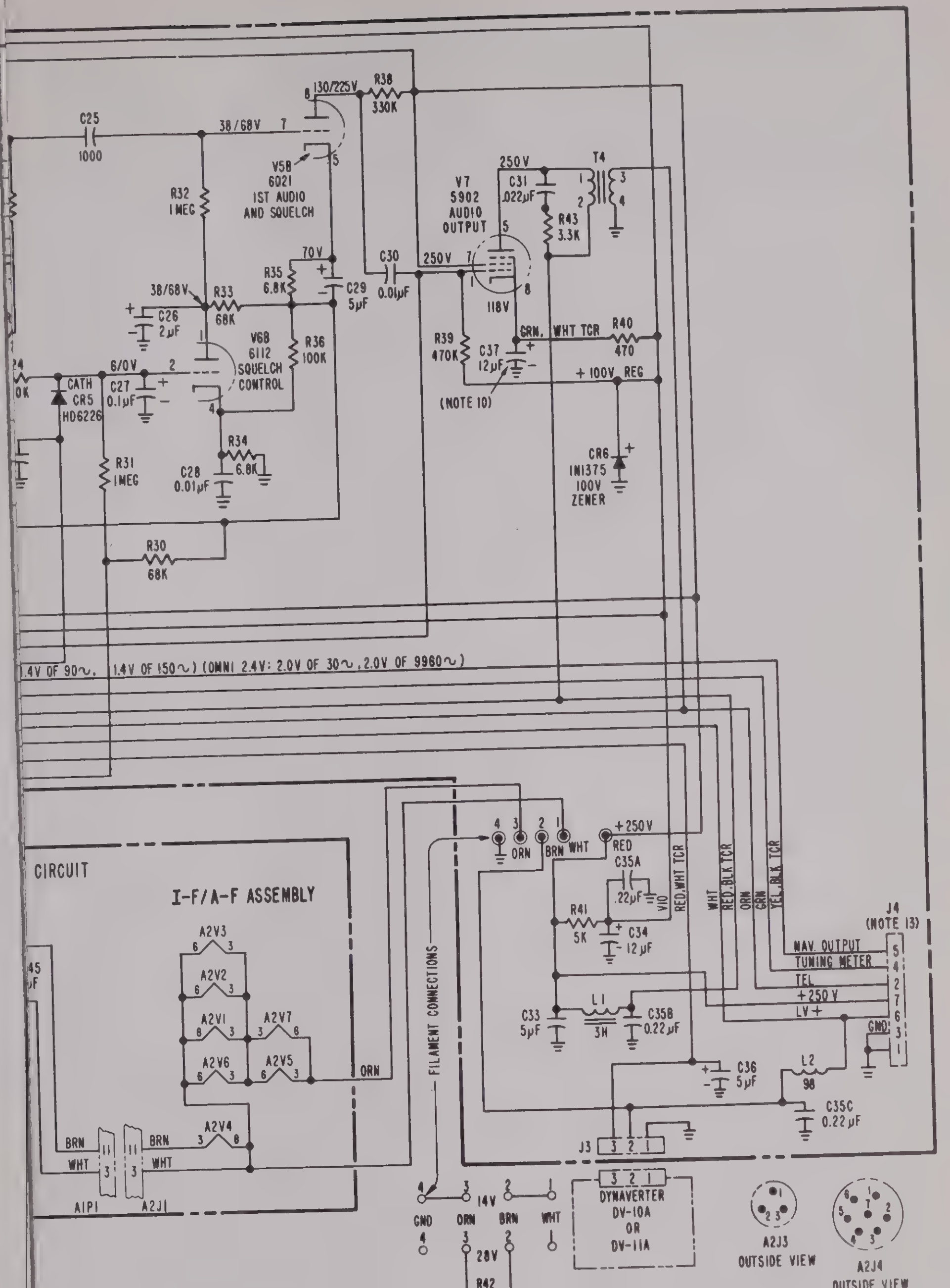

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Figure 6–1. R-34A Receiver, Schematic Diagram

SECTION VI

DIAGRAMS

TABLE I. ARC PART NUMBERS

Reference Designation	ARC Part No.
A1	
C1	19929
C2	8363
C3	8765-0100
C4	19929
C5	19897
C6	8541
C7	8879-9392
C8	8363
C9	8908-0511
C10	8832
C11	14143
C12	14143
C13	14143
C14	[3]8769-*
C15	19946
C16	24685
C17	8837
C18	8879-9822
C19	8848
C20	8278
C21	19946
C22	8554
C23	8835
C24	8835
C25	8835
C26	8837
C27	8837
C28	19929
C29	19603
C30	8870-0510
C31	8832
C32	8870-0510
C33	8535
C34	8832
C35	8870-0101
C36	8765-9701
C37	8870-0510
C38	8870-0241
C39	8832
C40	14143
C41	21485-9101
C42	14143
C43	8832
C44	14143
C45	21485-9101
C46	8832
C47	8706-0511
C48	8627-9103
C49	8627-9103
C50	8627-9103
C51	8627-9103
C52	8627-9103
C53	8627-9103
C54	8627-9103
C55	8627-9103
C56	8627-9103
C57	8627-9103
C58	8627-9103
C59	8627-9103
C60	8627-9103
C61	8627-9103
C62	8627-9103
C63	8627-9103
C64	8627-9103
C65	8627-9103
C66	8627-9103
C67	8766-0300
J1	15185
J2	12357
J3	11905
L1	22112
L2	8877-9222
L3	22113
L4	22114
L5	19715
L6	19715
L7	22116
L8	8877-9331
L9	8877-9682
L10	22115
L11	8877-0150
L12	8877-9271
L13	8877-0120
P1	22813
P2	19339
P3	22815
P4	19339
P5	p/o 22097
P6	11934
R1	200-0104
R2	200-0101
R3	204-0330
R4	200-0474
R5	200-0474
R6	200-0474
R7	200-0222
R8	200-0224
R9	200-0823
R10	200-0222
R11	200-0823
R12	200-0681
R13	200-0224
R14	200-0222
R15	200-0104
R16	200-0331
R17	8915-0502
R18	200-0104
R19	200-0333
R20	8915-0104
R21	204-0100
R22	200-0332
R23	200-0152
R24	200-0333
R25	200-0221
R26	200-0221
R27	200-0104
R28	201-0393
R30	200-0683
S1	p/o 23696
S2	p/o 23695
T1	22124
V1	700-0122
V2	700-0122
V3	700-0132
V4	700-0132
V5	700-0132
V6	700-0136
V7	700-0122
Y1	19658-4815
Y2	19658-4915
Y3	19658-5015
Y4	19658-5115
Y5	19658-5215
Y6	19658-5315
Y7	19658-5415
Y8	19658-5515
Y9	19658-5615
Y10	19658-5715
Y11	19658-5665
Y12	19658-5565
Y13	19658-5465
Y14	19658-5365
Y15	19658-5265
Y16	19658-5165
Y17	19658-5065
Y18	19658-4965
Y19	19658-4865
Y21	19657-1000
Y22	19657-1010
Y23	19657-1020
Y24	19657-1030
Y25	19657-1040
Y26	19657-1050
Y27	19657-1060
Y28	19657-1070
Y29	19657-1080
Y30	19657-1090
A2	
C1	8837
C2	8706-0101
C3	8837
C4	8837
C5	8837
C6	8837
C7	8837
C8	8837
C9	21485-9221
C10	8837
C11	8837
C12	8837
C13	8837
C14	8837
C15	21485-9221
C16	8908-0241
C17	8870-0101
C18	8870-0101
C19	8900-9102
C20	8870-0101
C21	8837
C22	8908-0511
C23	21485-9102
C24	8837
C25	8908-0102
C26	8851
C27	21485-9102
C28	8837
C29	8881-0007
C30	8835
C31	8890-9223
C33	6350
C34	8777
C35	5413
C36	6350
C37	8777
C38	8627-9103
C39	8627-9103
C40	8627-9103
C41	8627-9103
CR1	23037
CR2	23037
CR3	23037
CR4	22298-0680
CR5	23037
CR6	22298-0101
J1	p/o 22102
J2	19323
J3	4718
J4	5488
L1	5634
L2	5546
R1	200-0473
R2	200-0104
R3	200-0151
R4	200-0472
R5	200-0222
R6	200-0151
R7	200-0472
R8	200-0222
R9	200-0104
R10	200-0181
R11	201-0393
R12	200-0221
R13	200-0224
R14	200-0153
R15	200-0334
R16	200-0104
R17	200-0333
R18	200-0331
R19	200-0223
R20	200-0103
R21	200-0103
R22	200-0104
R23	200-0224
R24	200-0224
R25	200-0474
R26	200-0683
R27	200-0105
R28	200-0334
R29	200-0334
R30	200-0683
R31	200-0105
R32	200-0105
R33	200-0683
R34	200-0682
R35	200-0682
R36	200-0104
R37	202-0563
R38	200-0334
R39	200-0474
R40	202-0471
R41	3065
R42	209-9301
R43	200-0332
R44	[3]200-*
R45	[3]200-*
T1	22124
T2	22124
T3	22126
T4	20679
V1	700-0132
V2	700-0132
V3	700-0129
V4	700-0131
V5	700-0136
V6	700-0139
V7	700-0133
A3	
B1	[1]18800
B1	[2]18801
C1	8625-9104
CR1	23037
CR2	23037
J1	p/o 23946
J2	22105
J3	p/o 23946
J4	22105
K1	[1]19664
K1	[2]19665
K2	[1]19664
K2	[2]19665
L1	8877-0150
MP1	19443
MP2	19443
P1	19546

[1]For 14-volt model.
[2]For 28-volt model.
[3]To complete part number, insert value in place of asterisk.

TABLE II. CHANNEL SELECTION CONTROL CIRCUIT CODE

Fractional Megacycle Control Circuit		Crystal Drum Position																				Megacycle Control Circuit	
		.00	—	.10	—	.20	—	.30	—	.40	—	.50	—	.60	—	.70	—	.80	—	.90	—		
		108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	—		
A1J2 Terminal	A3MP1 Contact	Condition																				A1J2 Terminal	A3MP2 Contact
N	1	G	G	G	G	X	X	X	G	X	X	G	G	X	X	X	X	X	G	X	G	L	1
O	2	G	G	X	G	X	G	X	X	G	G	X	X	X	G	X	X	X	X	G	G	K	2
P	3	X	G	X	G	X	G	G	G	X	X	X	G	X	X	X	G	G	X	G	X	J	3
Q	4	X	X	X	G	G	G	X	G	X	G	X	X	X	G	G	X	G	G	X	X	I	4
R	5	X	X	G	X	X	G	X	G	X	G	X	G	G	X	G	G	X	X	X	G	H	5

NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1, A2, OR A3; FOR EXAMPLE, A1J2.
2. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

ASSEMBLY NO.	ASSEMBLY OR SUBASSEMBLY	FIGURE NO.
A1	R-F/I-F	6-3
	LOWER R-F FRAME	6-4
	FIRST I-F FILTER	6-5
	MC CRYSTAL OSCILLATOR-DOUBLER	6-6
	FIRST MIXER	6-7
	R-F CASCODE AMPLIFIER	6-8
A2	I-F/A-F	6-9
	I-F/A-F PRINTED CIRCUITS	6-10
A3	TUNER	6-11

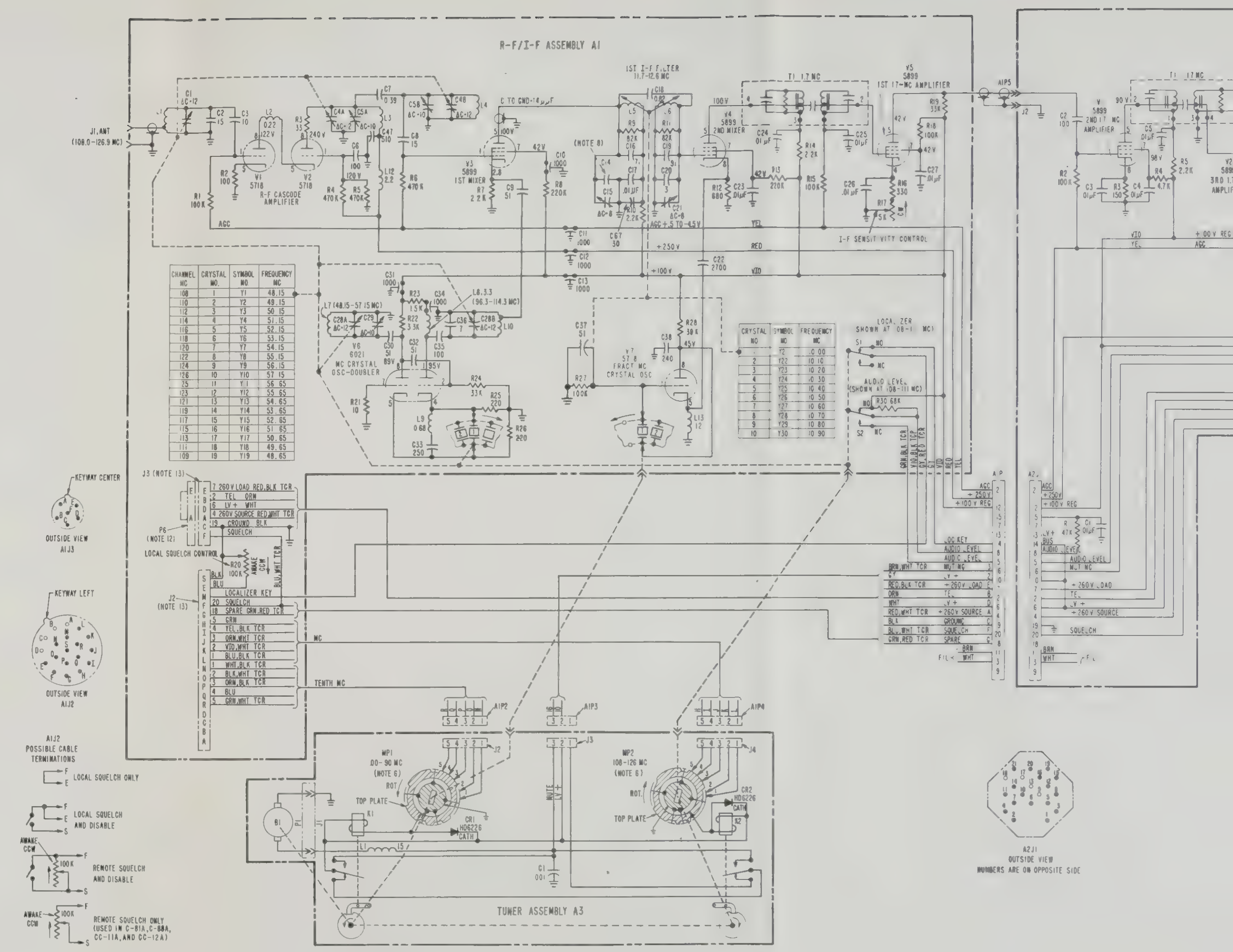
3. CAPACITOR VALUES ARE IN MICROMICROFARADS, UNLESS OTHERWISE NOTED.
4. RESISTOR VALUES ARE IN OHMS; MULTIPLIERS K=1000, MEG=1,000,000.
5. INDUCTOR VALUES ARE IN MICROHENRIES, UNLESS OTHERWISE NOTED.
6. TOP PLATES A3MP1 AND A3MP2 ARE SHOWN IN THE .00-MC AND 108-MC POSITIONS, RESPECTIVELY. REFER TO TABLE II FOR THE POSITION-CONTROL CODE. THE TABLE SHOWS THE CONDITION OF TERMINALS ON A1J2 FOR EACH POSITION OF THE FRACTIONAL MEGACYCLE AND MEGACYCLE CRYSTAL DRUMS. FOR A GIVEN CRYSTAL DRUM POSITION, TERMINALS LISTED WITH AN "X" IN THE APPROPRIATE "CONDITION" COLUMN ARE SHORTED TOGETHER AND INSULATED FROM GROUND BY THE ASSOCIATED TOP PLATE; TERMINALS LISTED WITH A "G" IN THE APPROPRIATE "CONDITION" COLUMN ARE CONNECTED TO GROUND BY THE ASSOCIATED TOP PLATE.
7. RELAYS ARE SHOWN IN THE DEENERGIZED POSITION.
8. VALUES OF THE FOLLOWING PARTS ARE SELECTED AND INSTALLED DURING FINAL FACTORY ADJUSTMENT:

REF DESIG	VALUE	FUNCTION
A2R44	47K TO 470K	DETERMINES PHASE SHIFT
A2R45	47K TO 470K	DETERMINES LEVEL OF NAV SIGNAL APPLIED TO CONVERTER
A1C14	3 $\mu\mu$F TO 15 $\mu\mu$F	ADJUSTS TRACKING OF 11-MC I-F COIL

9. D-C VOLTAGES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS:
   A. MEASUREMENTS MADE WITH A 20,000 OHMS-PER-VOLT VOLTMETER, NEGATIVE TERMINAL GROUNDED TO CHASSIS.
   B. WITH NO R-F SIGNAL APPLIED, VOLTAGES SEPARATED BY A SLANT (/) ARE OBTAINED AT EXTREME SETTINGS OF SQUELCH CONTROL A1R20.
   C. NO INPUT TO CONVERTER; VOLTAGES ARE 5% LOWER WHEN CONVERTER IS OPERATING.
   D. LV+ AT TERMINAL 2 OF A2J3 SET AT 13.75 VOLTS FOR 14-VOLT UNITS OR 27.5 VOLTS FOR 28-VOLT UNITS.
10. A2C37 IS NOT USED IN SERIAL NO. 117, 115, AND BELOW OF 28-VOLT UNITS.
11. A2CR1 IS USED ONLY IN SERIAL NO. 101 THROUGH 110, 112, 114, AND 117 OF 28-VOLT UNITS.
12. DYNAVERTER MAY BE USED TO SUPPLY 260 VOLTS 140 MA DC TO A TRANSMITTER CONNECTED TO A1J3.
13. TABLE III LISTS THE .01 BYPASS CAPACITORS CONNECTED TO TERMINALS OF A1J2, A2J3, AND A2J4.

TABLE III. BYPASS CAPACITOR LOCATIONS

Connector Terminal	Capacitor Ref Desig
A1J2	
E	C48
F	C49
G	C50
H	C51
I	C52
J	C53
K	C54
L	C55
M	C56
N	C57
O	C58
P	C59
Q	C60
R	C61
A1J3	
A	C62
B	C63
D	C64
E	C65
F	C66
A2J4	
2	C38
4	C39
6	C40
7	C41



LECTION CONTROL CIRCUIT CODE

stal Drum Position											Megacycle Control Circuit	
—	.50	—	.60	—	.70	—	.80	—	.90	—		
117	118	119	120	121	122	123	124	125	126	—		
Condition											A1J2 Terminal	A3MP2 Contact
X	G	G	X	X	X	X	X	G	X	G	L	1
G	X	X	X	G	X	X	X	X	G	G	K	2
X	X	G	X	X	X	G	G	X	G	X	J	3
[illegible]	X	X	X	G	G	X	G	G	X	X	I	4
G	X	G	G	X	G	G	X	X	X	G	H	5

PLETE IDENTIFICATION.
IGNATION A1, A2, OR

IATED WIRING DIA-

IGURE NO.
6-3
6-4
6-5
6-6
6-7
6-8
6-9
6-10
6-11
OTHERWISE NOTED.
G=1, 000, 000.
WISE NOTED.
C AND 108-MC PO-
OSITION-CONTROL
ON A1J2 FOR EACH
CLE CRYSTAL
ALS LISTED WITH AN
ORTED TOGETHER
PLATE; TERMINALS
OLUMN ARE CON-

NSTALLED DURING

T
AV SIGNAL

-MC I-F COIL
E FOLLOWING

VOLT VOLT-
SSIS.
ATED BY A
OF SQUELCH

VER WHEN

FOR 14-VOLT

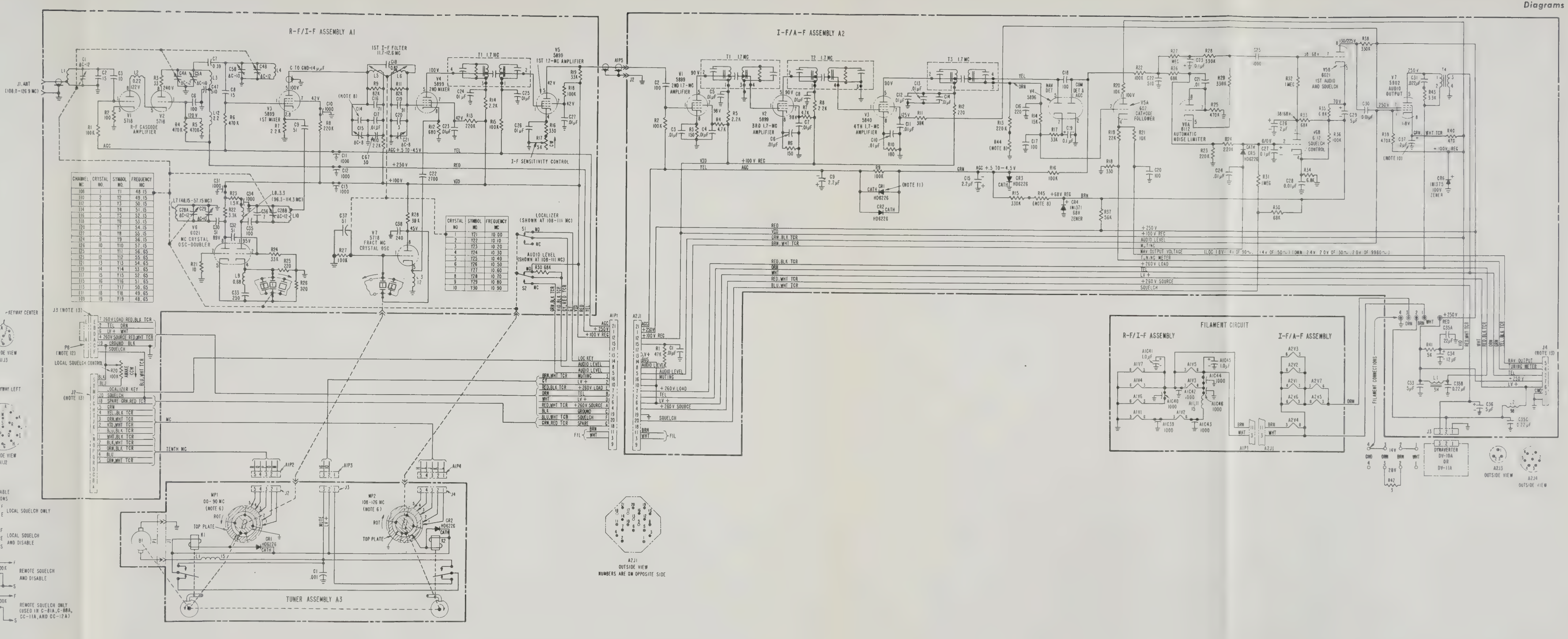
F 28-VOLT UNITS.
, 114, AND 117 OF

DC TO A TRANS-

TO TERMINALS OF

TABLE III. BYPASS CAPACITOR LOCATIONS

Connector Terminal	Capacitor Ref Desig
A1J2	
E	C48
F	C49
G	C50
H	C51
I	C52
J	C53
K	C54
L	C55
M	C56
N	C57
O	C58
P	C59
Q	C60
R	C61
A1J3	
A	C62
B	C63
D	C64
E	C65
F	C66
A2J4	
2	C38
4	C39
6	C40
7	C41

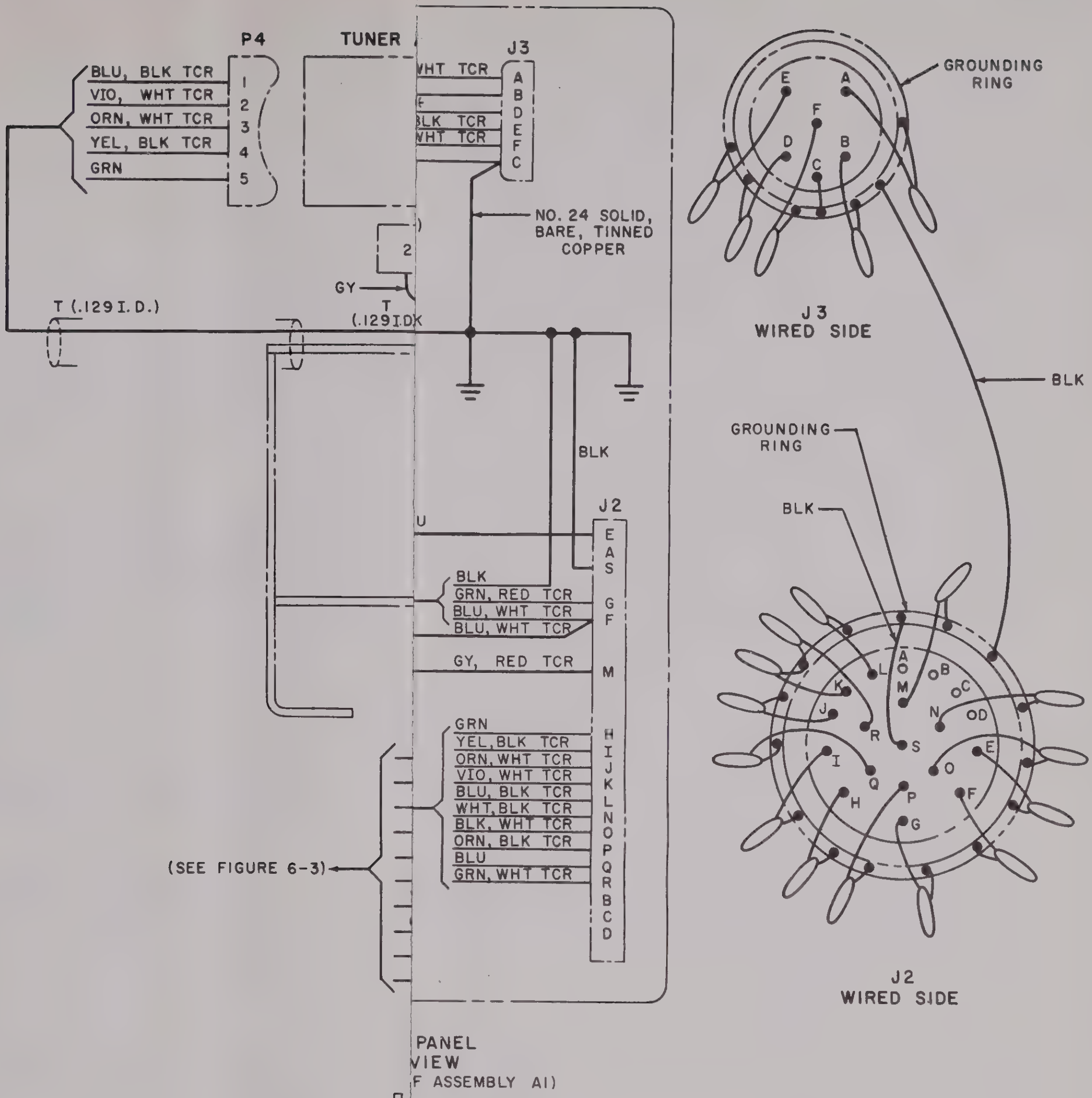


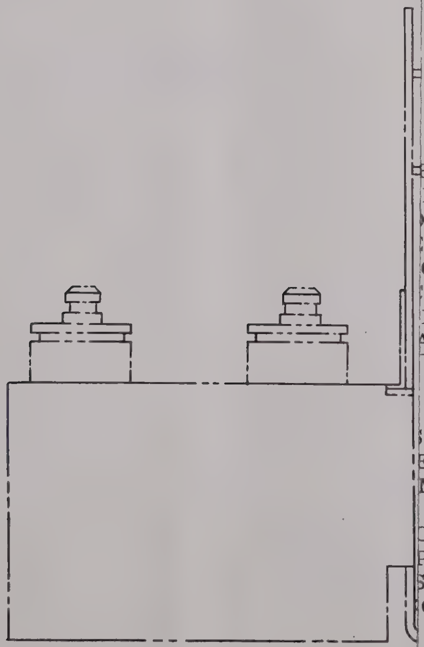
21442D

Figure 6–1. R-34A Receiver, Schematic Diagram

SECTION VI

DIAGRAMS





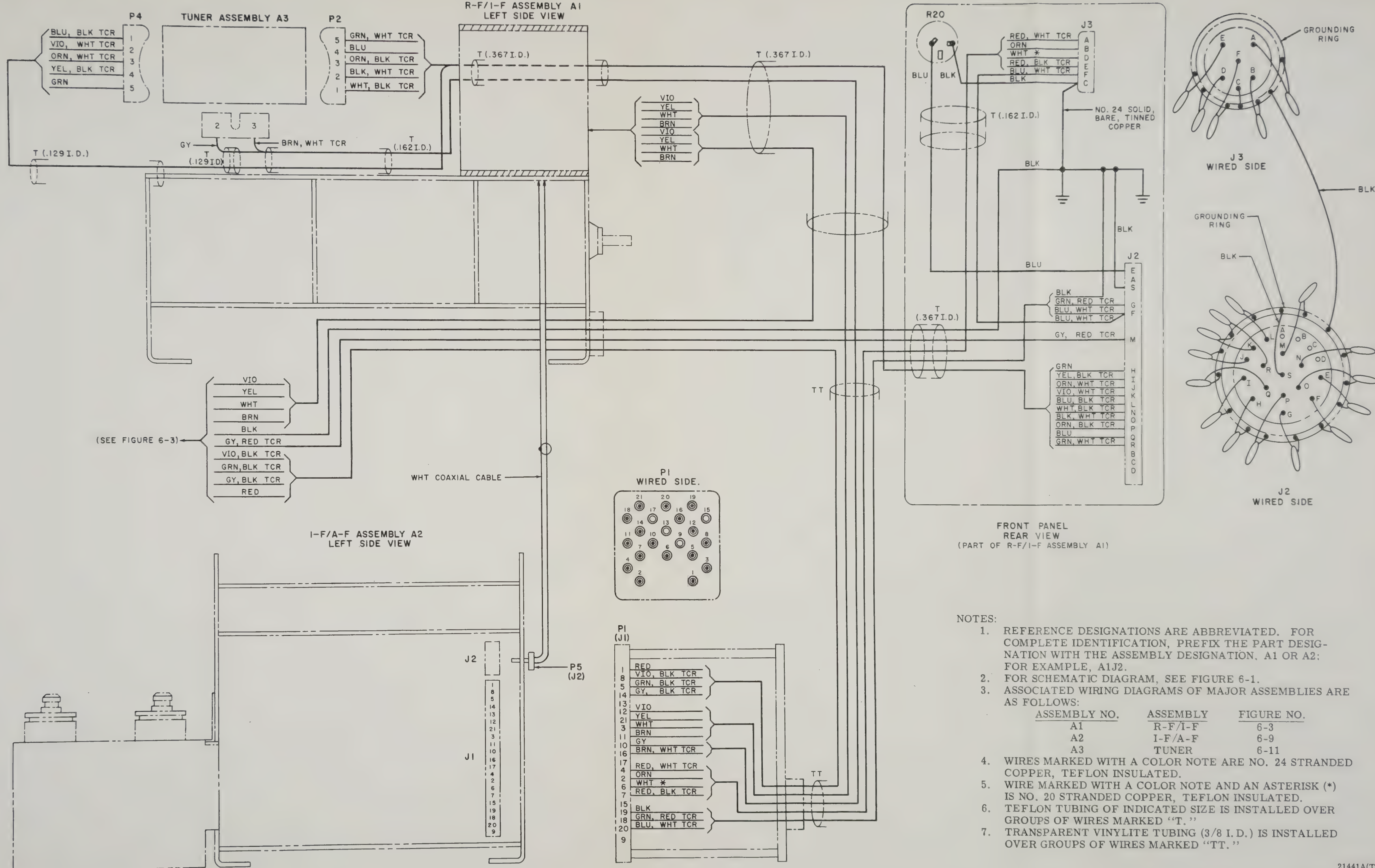
RENCE DESIGNATIONS ARE ABBREVIATED. FOR
LETE IDENTIFICATION, PREFIX THE PART DESIG-
N WITH THE ASSEMBLY DESIGNATION, A1 OR A2;
XAMPLE, A1J2.
CHEMATIC DIAGRAM, SEE FIGURE 6-1.
IATED WIRING DIAGRAMS OF MAJOR ASSEMBLIES ARE
LLOWS:

ASSEMBLY NO.	ASSEMBLY	FIGURE NO.
A1	R-F/I-F	6-3
A2	I-F/A-F	6-9
A3	TUNER	6-11

MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED
ER, TEFLON INSULATED.
MARKED WITH A COLOR NOTE AND AN ASTERISK (*)
20 STRANDED COPPER, TEFLON INSULATED.
ON TUBING OF INDICATED SIZE IS INSTALLED OVER
PS OF WIRES MARKED "T."
SPARENT VINYLITE TUBING (3/8 I. D.) IS INSTALLED
GROUPS OF WIRES MARKED "TT."

21441A(TP)

Figure 6–2. R-34A Receiver, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1 OR A2: FOR EXAMPLE, A1J2.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. ASSOCIATED WIRING DIAGRAMS OF MAJOR ASSEMBLIES ARE AS FOLLOWS:

ASSEMBLY NO.	ASSEMBLY	FIGURE NO.
A1	R-F/I-F	6-3
A2	I-F/A-F	6-9
A3	TUNER	6-11

4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
5. WIRE MARKED WITH A COLOR NOTE AND AN ASTERISK (*) IS NO. 20 STRANDED COPPER, TEFLON INSULATED.
6. TEFLON TUBING OF INDICATED SIZE IS INSTALLED OVER GROUPS OF WIRES MARKED "T."
7. TRANSPARENT VINYLITE TUBING (3/8 I. D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "TT."

21441A(TP)

Figure 6–2. R-34A Receiver, Wiring Diagram

NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C3.

2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2. ASSOCIATED SUBASSEMBLY WIRING DIAGRAMS ARE AS FOLLOWS:

SUBASSEMBLY	FIGURE NO.
LOWER R-F FRAME	6-4
FIRST I-F FILTER	6-5
MC CRYSTAL OSCILLATOR-DOUBLER	6-6
FIRST MIXER	6-7
R-F CASCODE AMPLIFIER	6-8

4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.

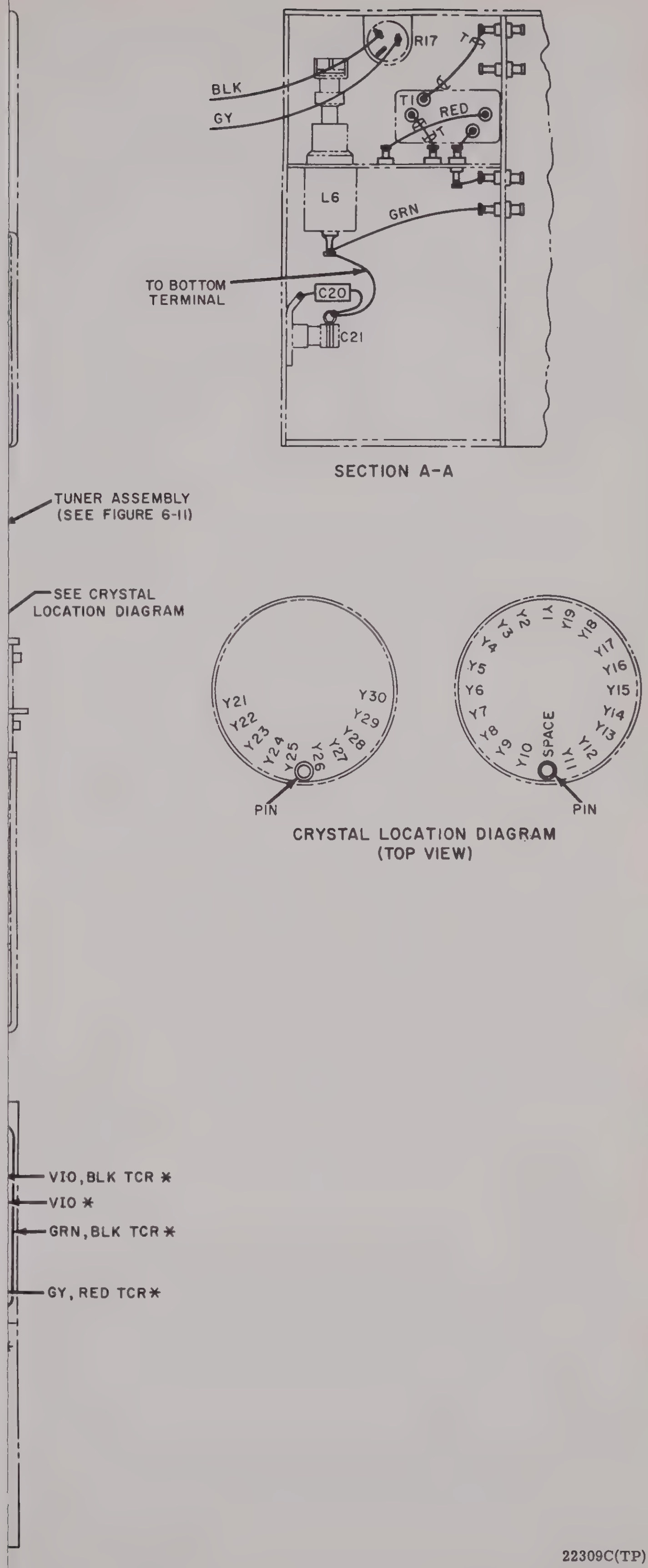
5. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.

6. UNMARKED WIRES ARE NO. 24 BARE, SOLID COPPER.

7. INDICATES WIRES TWISTED TOGETHER.

8. TEFLON TUBING (0.025 MINIMUM I.D.) IS INSTALLED OVER WIRES MARKED "T." TEFLON TUBING (0.072 I.D.) IS INSTALLED OVER WIRE MARKED "TT."

9. VALUE IS DETERMINED AT TIME OF FINAL ADJUSTMENT; LIMITING VALUES: 3 — 15 $\mu\mu$F.



22309C(TP)

Figure 6–3. R-34A Receiver, R-f/I-f Assembly, Wiring Diagram

NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C3.

2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2. ASSOCIATED SUBASSEMBLY WIRING DIAGRAMS ARE AS FOLLOWS:

SUBASSEMBLY	FIGURE NO.
LOWER R-F FRAME	6-4
FIRST I-F FILTER	6-5
MC CRYSTAL OSCILLATOR-DOUBLER	6-6
FIRST MIXER	6-7
R-F CASCODE AMPLIFIER	6-8

4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.

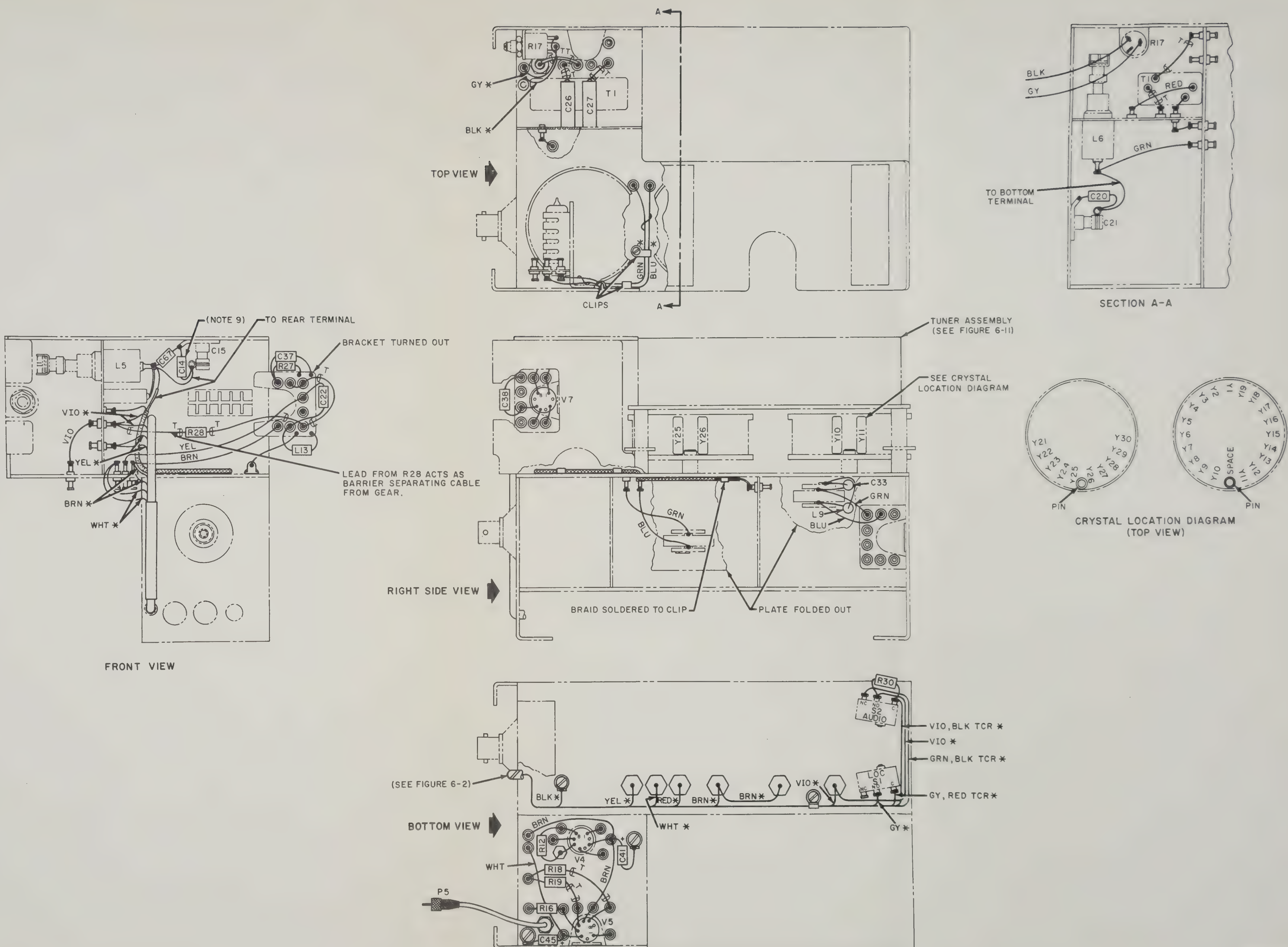
5. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.

6. UNMARKED WIRES ARE NO. 24 BARE, SOLID COPPER.

7. ≈ INDICATES WIRES TWISTED TOGETHER.

8. TEFLON TUBING (0.025 MINIMUM I.D.) IS INSTALLED OVER WIRES MARKED "T." TEFLON TUBING (0.072 I.D.) IS INSTALLED OVER WIRE MARKED "TT."

9. VALUE IS DETERMINED AT TIME OF FINAL ADJUSTMENT; LIMITING VALUES: 3 — 15 $\mu\mu F$.



22309C(TP)

Figure 6–3. R-34A Receiver, R-f/I-f Assembly, Wiring Diagram

NOTES:

1. REFEI
TIFIC
DESIG

2. FOR S

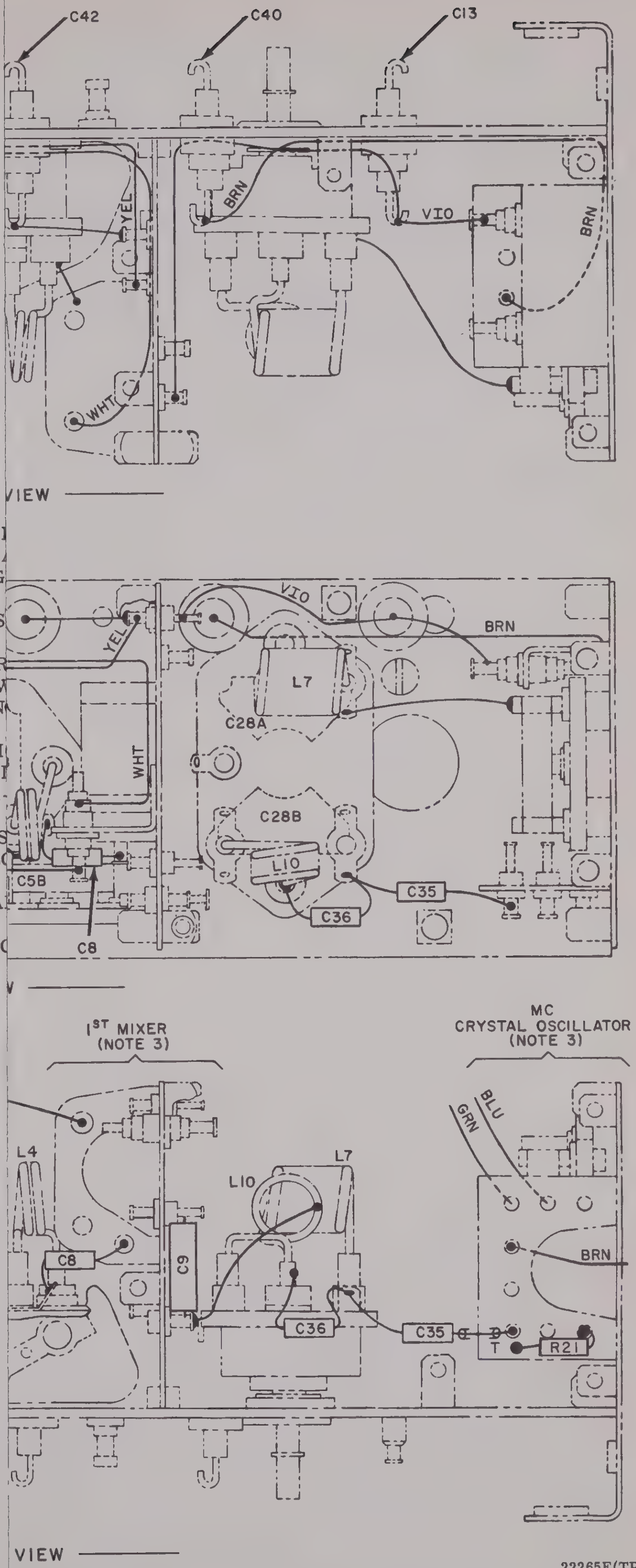
3. FOR R
BLY W
WIRIN

M
FI
R-

4. WIRES
TEFL

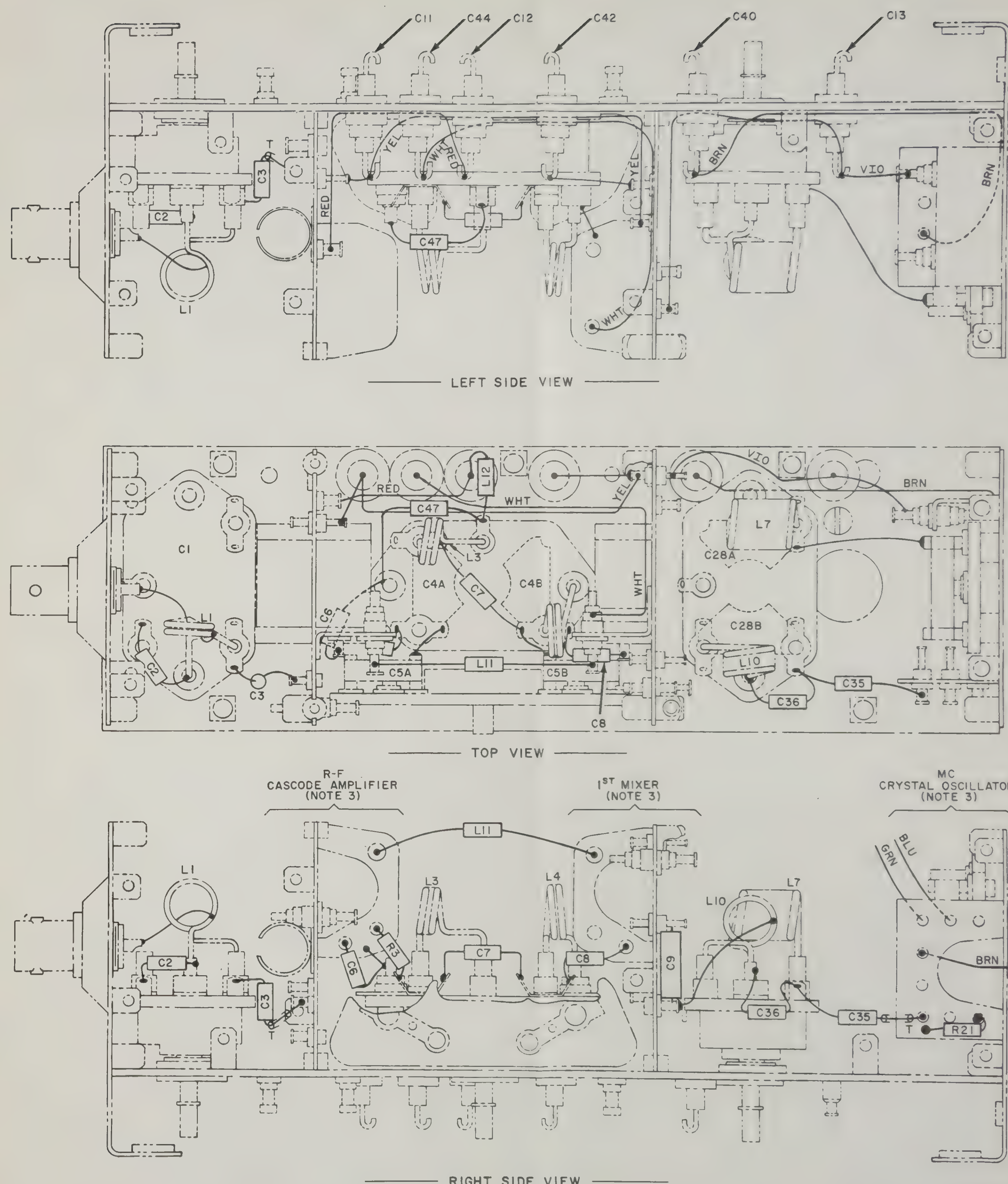
5. UNMA

6. TEFL



22265E(TP)

Figure 6–4. R-34A Receiver, R-f/I-f Assembly, Lower R-f Frame, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C11.

2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2. FOR R-F/I-F ASSEMBLY WIRING DIAGRAM, SEE FIGURE 6-3. ASSOCIATED SUBASSEMBLY WIRING DIAGRAMS ARE AS FOLLOWS:

SUBASSEMBLY	FIGURE NO.
MC CRYSTAL OSCILLATOR-DOUBLER	6-6
FIRST MIXER	6-7
R-F CASCODE AMPLIFIER	6-8

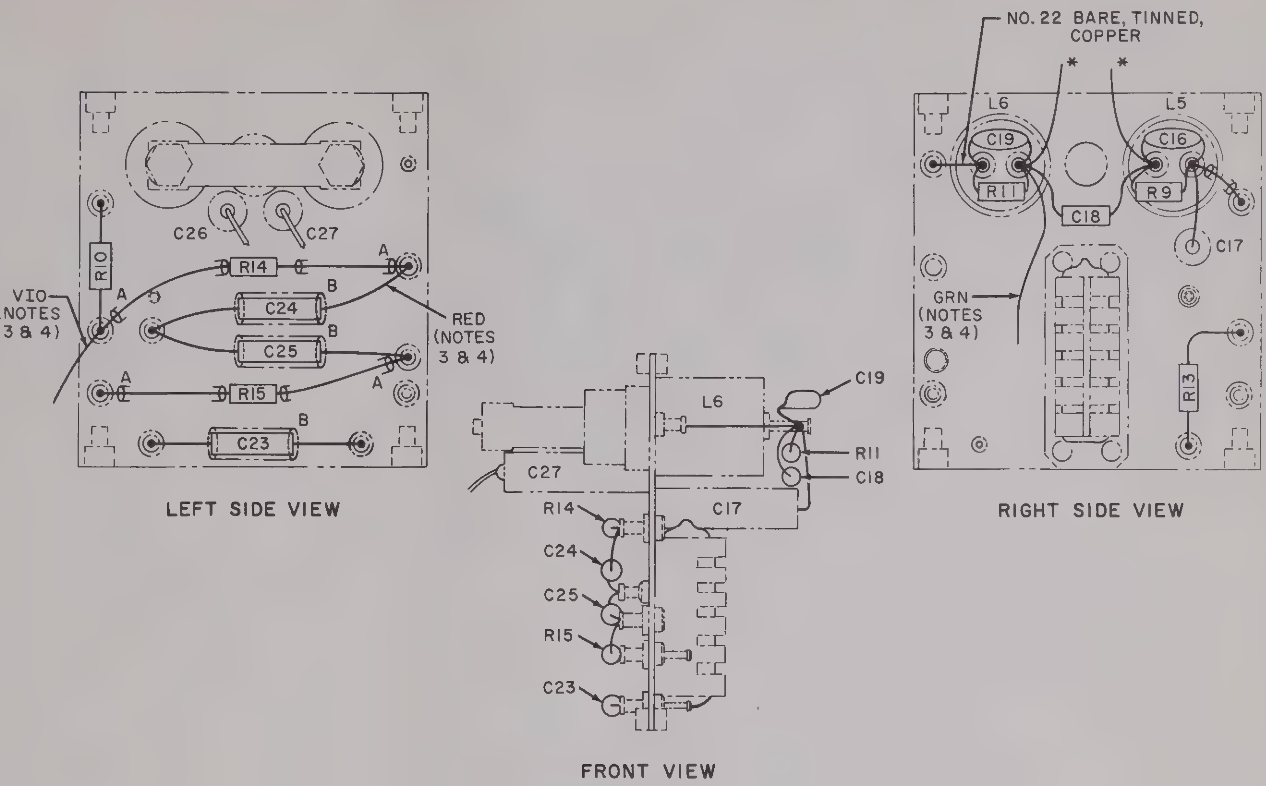
4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.

5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.

6. TEFLON TUBING (0.025 I.D.) IS INSTALLED OVER WIRES MARKED "T."

22265E(TP)

Figure 6–4. R-34A Receiver, R-f/I-f Assembly, Lower R-f Frame, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C27.

2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR ASSEMBLY INTERCONNECTION DIAGRAMS, SEE FIGURES 6-2 AND 6-3.

4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.

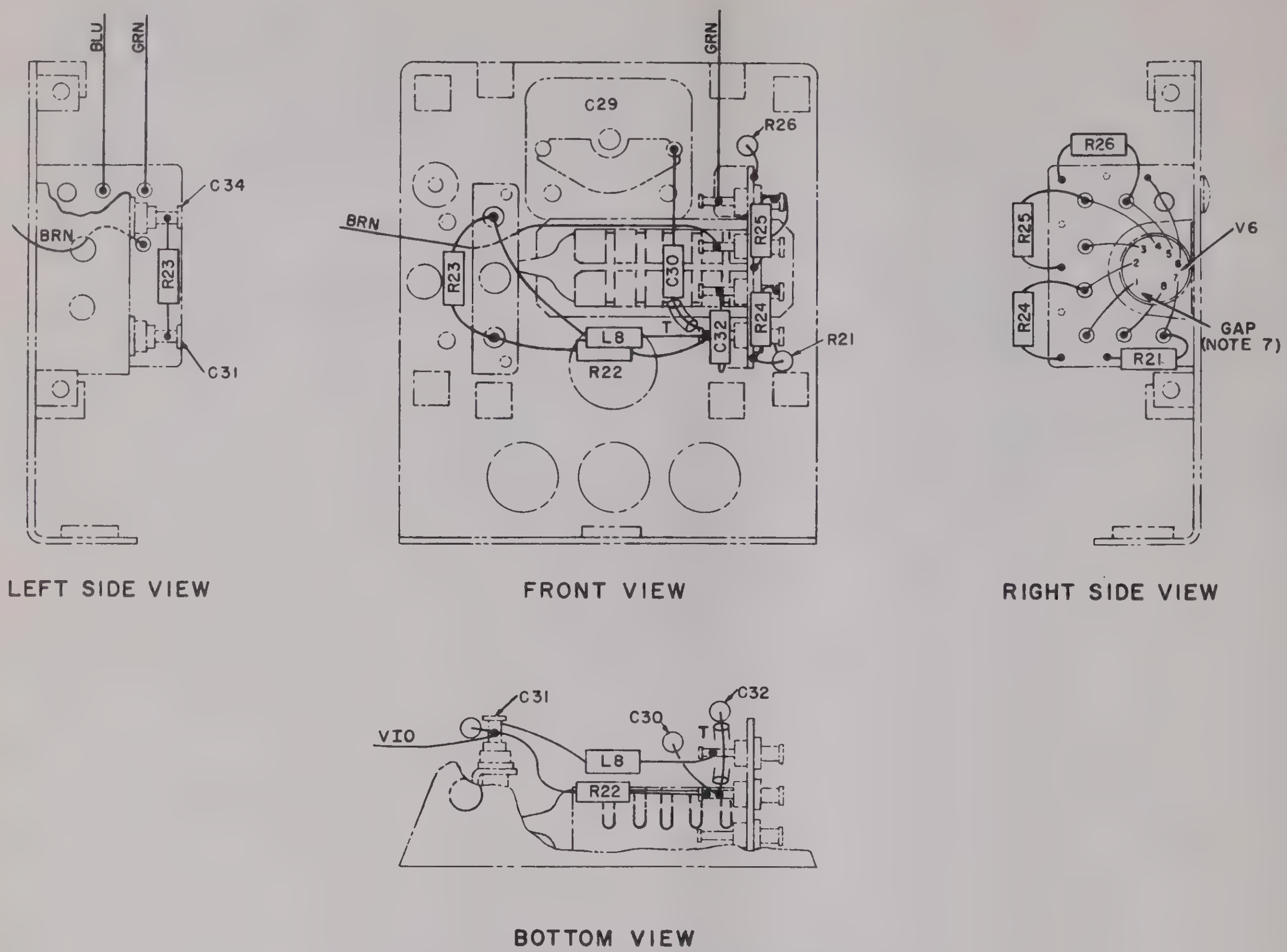
5. WIRES MARKED WITH AN ASTERISK (*) ARE NO. 22 BARE, TINNED COPPER AND CONNECT TO PARTS ON THE MAIN ASSEMBLY (SEE FIGURE 6-3).

6. TEFLON TUBING (0.025 I. D.) IS INSTALLED OVER WIRE MARKED "T."

7. TEFLON TUBING (0.025 I. D.) IS INSTALLED AT LOCATIONS MARKED "A." TRANSPARENT VINYLITE TUBING (0.234 I. D.) IS INSTALLED AT LOCATIONS MARKED "B."

22264B

Figure 6–5. R-34A Receiver, First I-f Filter, Wiring Diagram

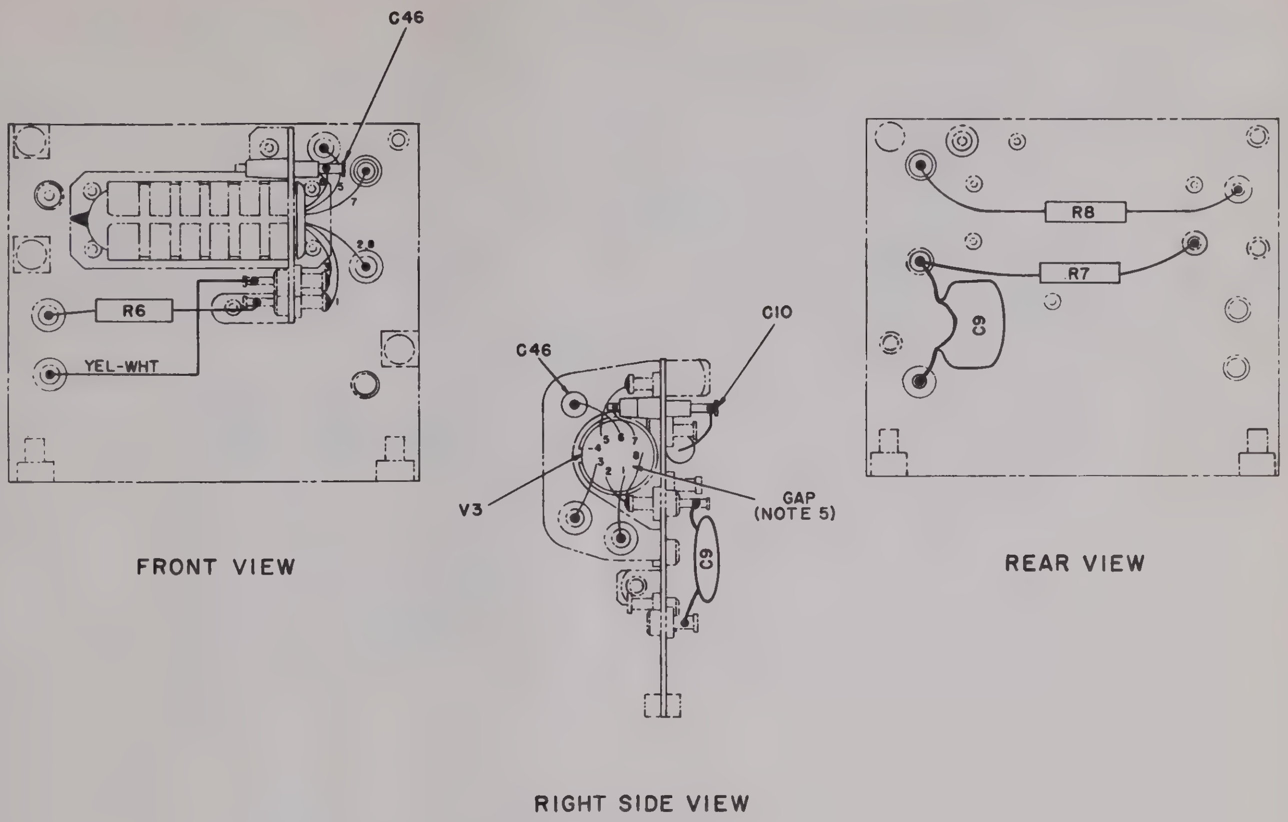


NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C31.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR ASSEMBLY INTERCONNECTION DIAGRAMS, SEE FIGURES 6-3 AND 6-4.
4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
6. TEFLON TUBING (0.025 I.D.) IS INSTALLED OVER WIRE MARKED "T."
7. V6 IS VIEWED TOWARD BASE IN RIGHT SIDE VIEW. ORIENT TUBE IN CLIP AS SHOWN. DRESS BARE TUBE LEADS WITH 1/16" MINIMUM CLEARANCE.

22266B

Figure 6–6. R-34A Receiver, Megacycle Crystal Oscillator-Doubler, Wiring Diagram

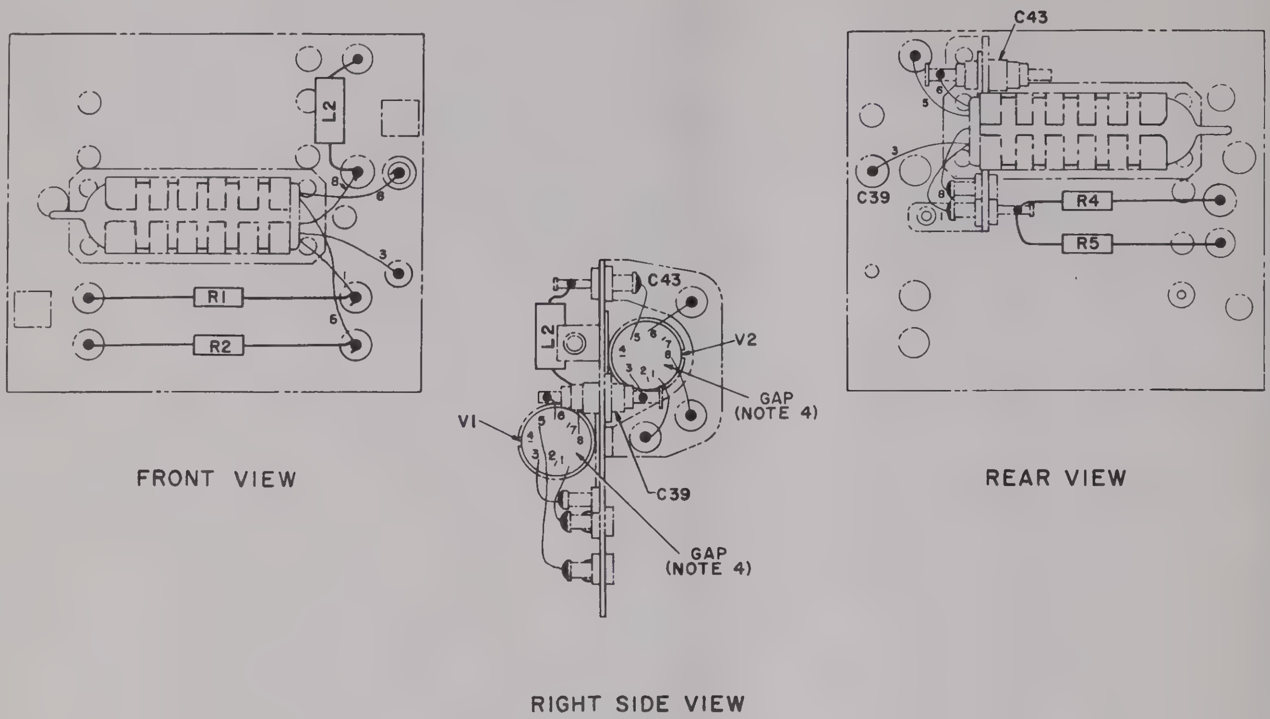


NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C44.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR ASSEMBLY INTERCONNECTION DIAGRAM, SEE FIGURE 6-4.
4. WIRE MARKED WITH COLOR NOTE IS NO. 24 SOLID COPPER, TEFLON INSULATED.
5. V3 IS VIEWED TOWARD BASE IN RIGHT SIDE VIEW. ORIENT TUBE IN CLIP AS SHOWN. DRESS BARE TUBE LEADS WITH 1/16'' MINIMUM CLEARANCE. CUT OFF UNUSED LEAD NO. 4 APPROXIMATELY 1/32'' FROM GLASS.

22268C

Figure 6–7. R-34A Receiver, First Mixer, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C43.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR ASSEMBLY INTERCONNECTION DIAGRAM, SEE FIGURE 6-4.
4. V1 AND V2 ARE VIEWED TOWARD BASE IN RIGHT SIDE VIEW. ORIENT TUBES IN CLIP AS SHOWN. DRESS BARE TUBE LEADS WITH 1/16" MINIMUM CLEARANCE. CUT OFF UNUSED LEADS NO. 2, 4, AND 7 APPROXIMATELY 1/32" FROM GLASS.

22610A

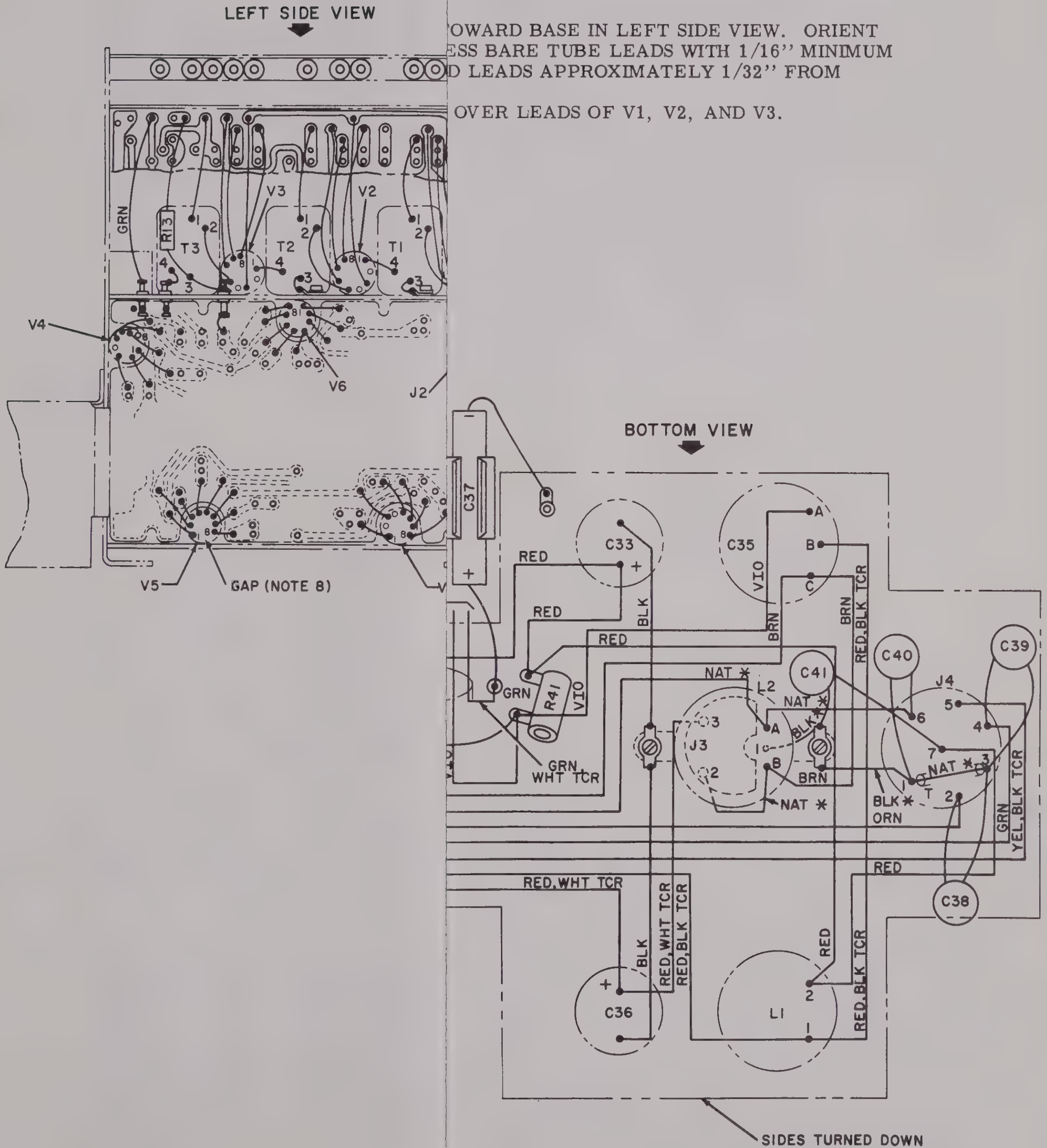
Figure 6–8. R-34A Receiver, R-f Cascode Amplifier, Wiring Diagram

E ABBREVIATED. FOR COMPLETE IDENTI-
DESIGNATION WITH THE ASSEMBLY DESIG-
2C1.
E FIGURE 6-1.
M, SEE FIGURE 6-2. FOR ASSOCIATED
E 6-10.
NOTE ARE NO. 24 SOLID COPPER, TEFLON

NOTE AND AN ASTERISK (*) ARE NO. 20
NSULATED.
BARE, SOLID, TINNED COPPER.
ATE SIZE AND LENGTH IS INSTALLED OVER

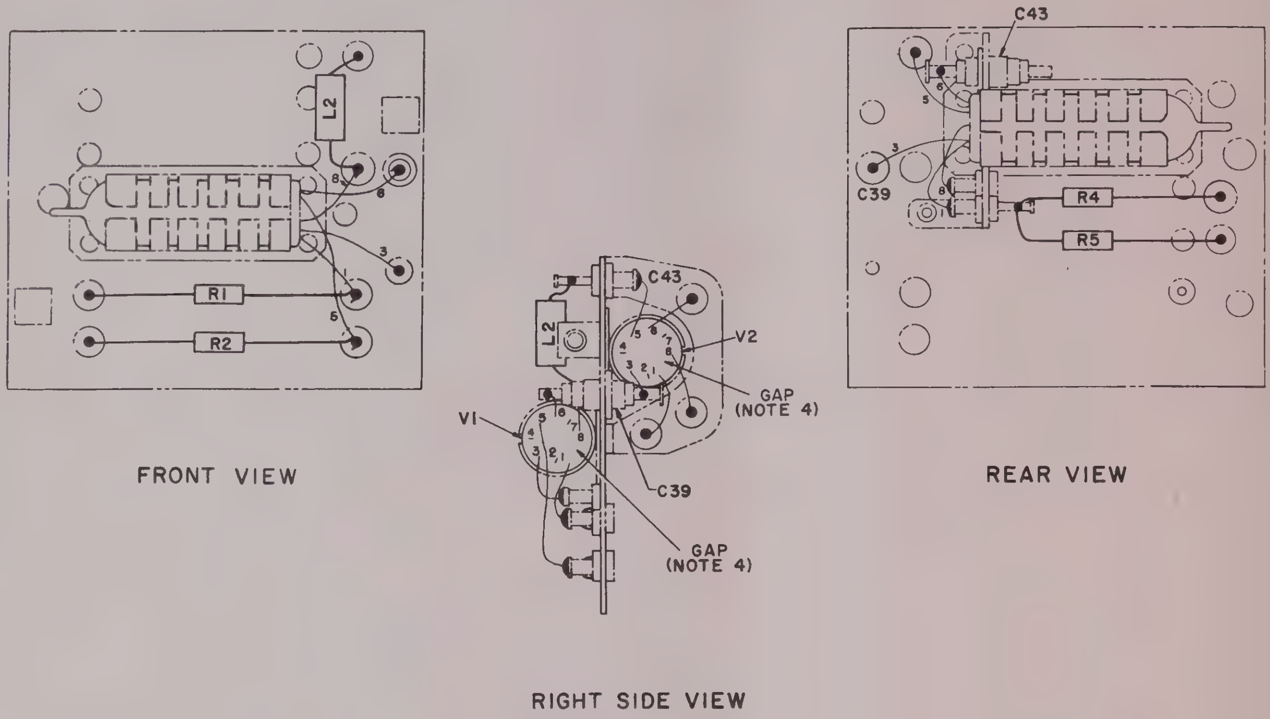
OWARD BASE IN LEFT SIDE VIEW. ORIENT
ESS BARE TUBE LEADS WITH 1/16'' MINIMUM
D LEADS APPROXIMATELY 1/32'' FROM

OVER LEADS OF V1, V2, AND V3.



22300C(TP)

Figure 6–9. R-34A Receiver, I-f/A-f Assembly, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A1; FOR EXAMPLE, A1C43.

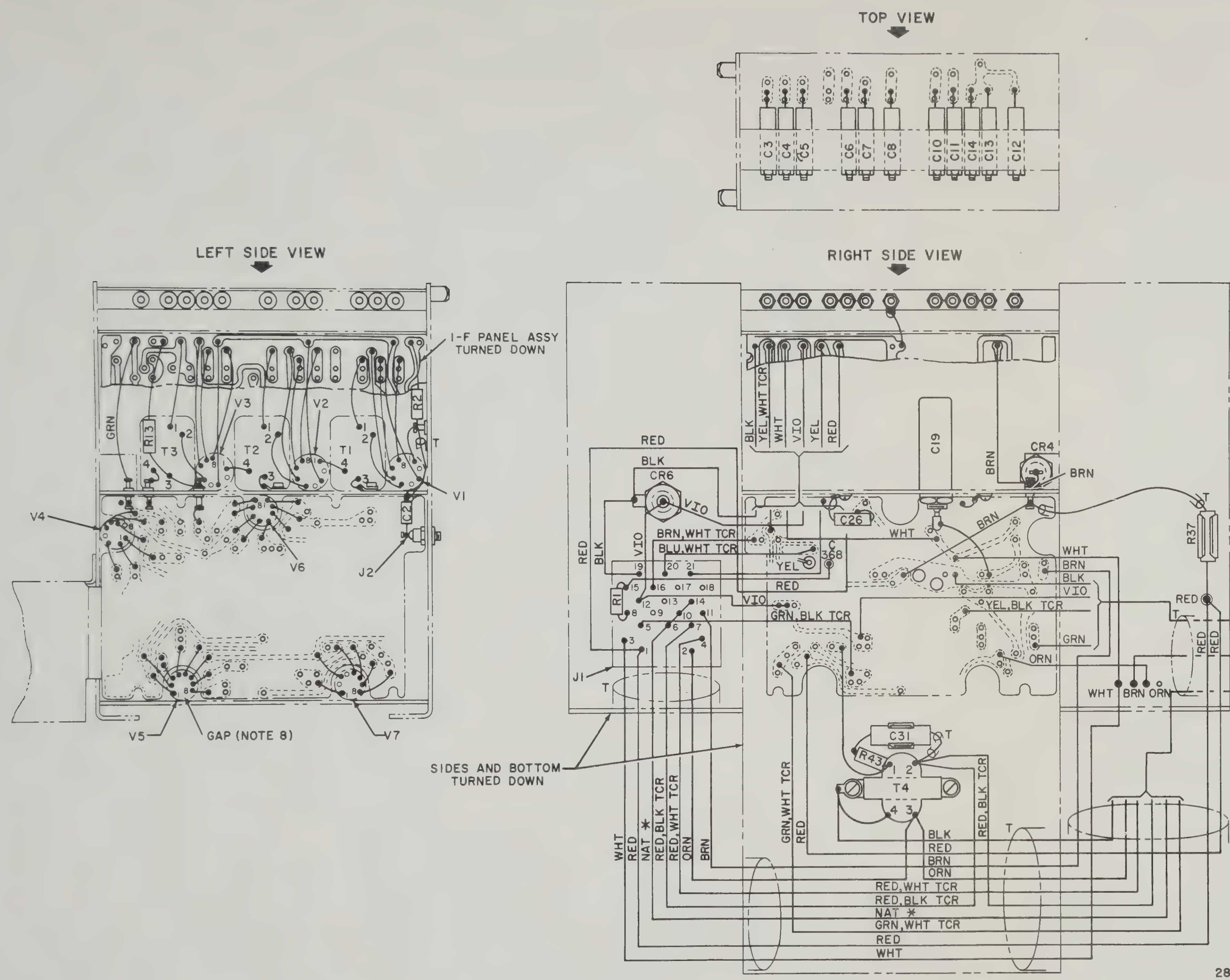
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR ASSEMBLY INTERCONNECTION DIAGRAM, SEE FIGURE 6-4.

4. V1 AND V2 ARE VIEWED TOWARD BASE IN RIGHT SIDE VIEW. ORIENT TUBES IN CLIP AS SHOWN. DRESS BARE TUBE LEADS WITH 1/16'' MINIMUM CLEARANCE. CUT OFF UNUSED LEADS NO. 2, 4, AND 7 APPROXIMATELY 1/32'' FROM GLASS.

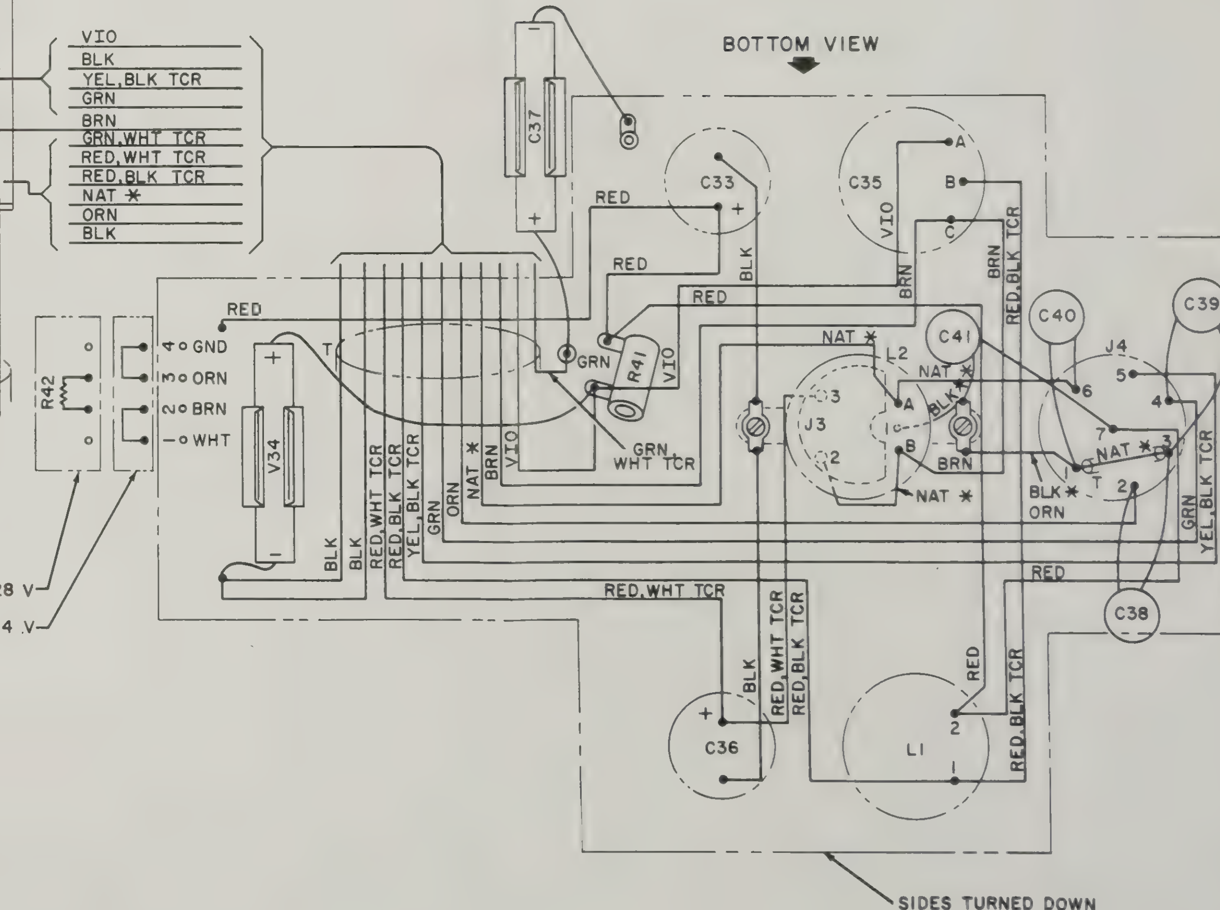
22610A

Figure 6–8. R-34A Receiver, R-f Cascode Amplifier, Wiring Diagram



NOTES:

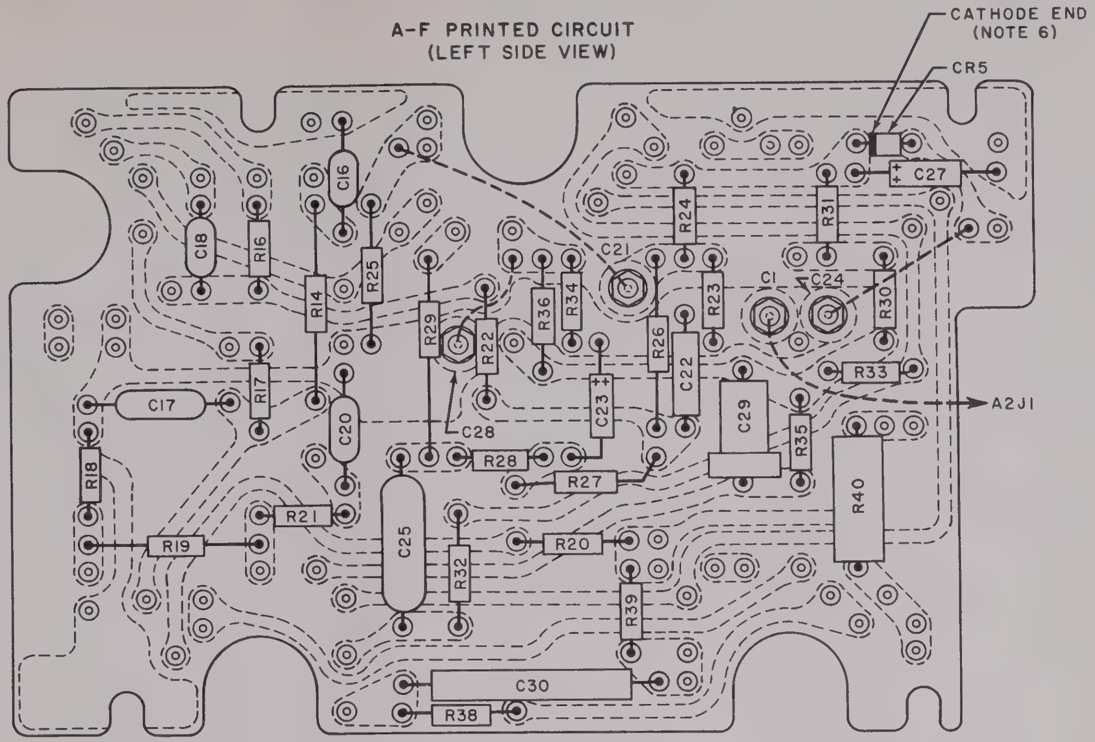
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A2; FOR EXAMPLE, A2C1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2. FOR ASSOCIATED WIRING DIAGRAMS, SEE FIGURE 6-10.
4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
5. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 20 STRANDED COPPER. TEFLON INSULATED.
6. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
7. TEFLON TUBING OF APPROPRIATE SIZE AND LENGTH IS INSTALLED OVER WIRES MARKED "T."
8. VACUUM TUBES ARE VIEWED TOWARD BASE IN LEFT SIDE VIEW. ORIENT TUBES IN CLIP AS SHOWN. DRESS BARE TUBE LEADS WITH 1/16" MINIMUM CLEARANCE. CUT OFF UNUSED LEADS APPROXIMATELY 1/32" FROM GLASS.
9. TEFLON TUBING IS INSTALLED OVER LEADS OF V1, V2, AND V3.



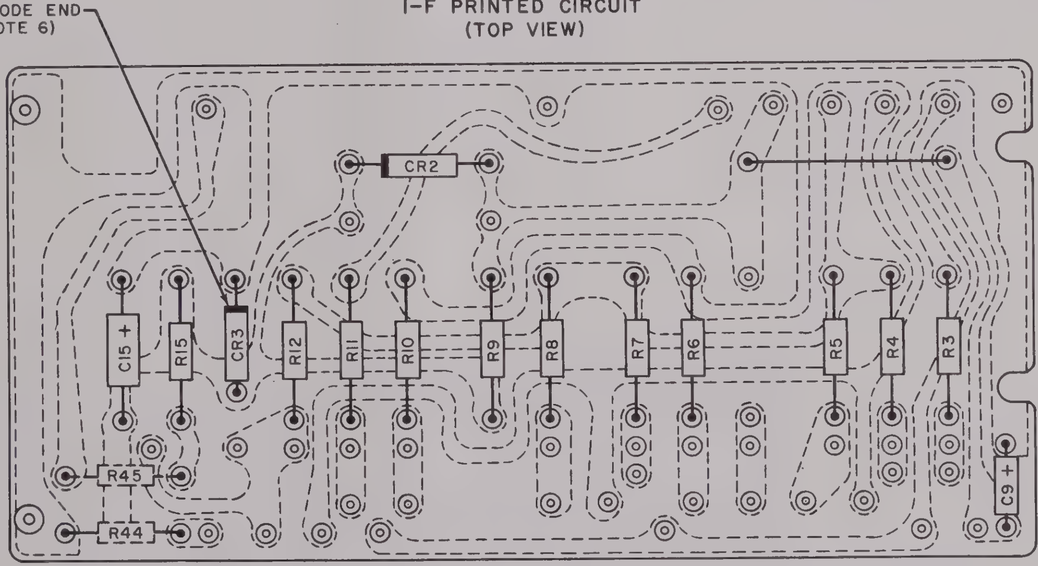
22300C(TP)

Figure 6–9. R-34A Receiver, I-f/A-f Assembly, Wiring Diagram

A-F PRINTED CIRCUIT
(LEFT SIDE VIEW)



I-F PRINTED CIRCUIT
(TOP VIEW)

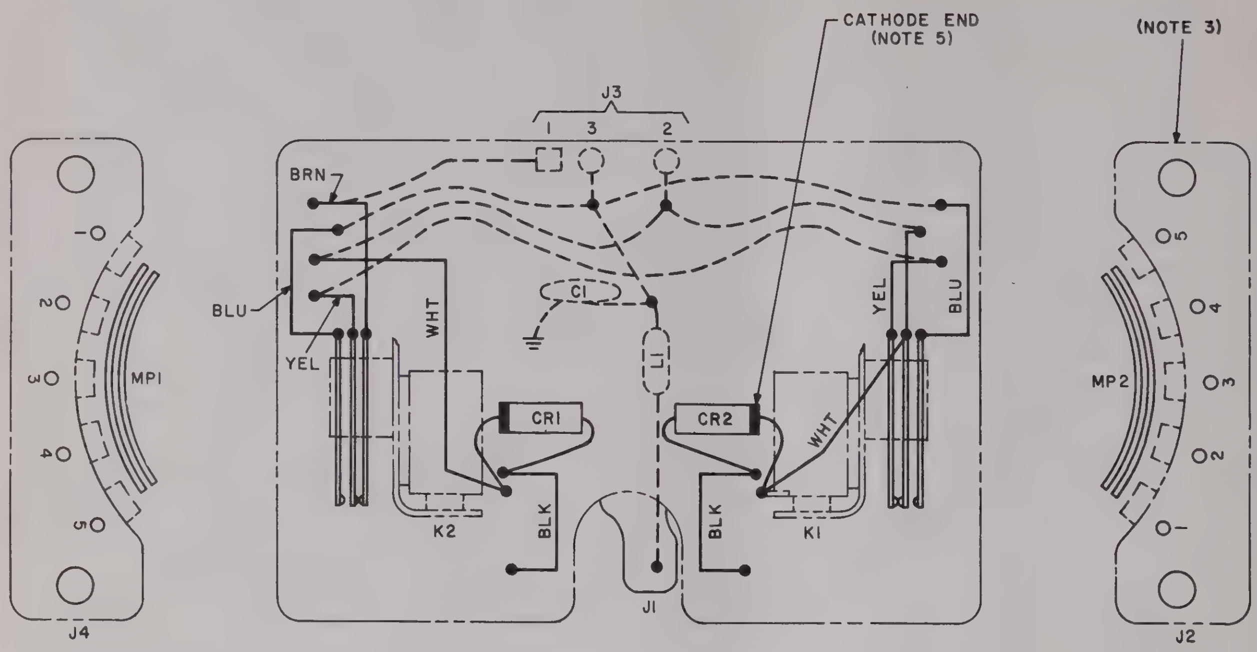


NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A2; FOR EXAMPLE, A2C16.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR ASSEMBLY INTERCONNECTION DIAGRAM, SEE FIGURE 6-9.
4. SHADED AREAS DENOTE UNETCHED COPPER.
5. BARE LEADS OF C1, C21, C24, AND C28 ARE COVERED WITH TEFLON TUBING (0.036 I.D.) OF SUFFICIENT LENGTH TO INSULATE THE LEADS FROM THE TOP RIMS OF THE CAPACITORS.
6. DARK BAND ON CRYSTAL DIODE INDICATES END NEAREST COLOR CODING BANDS.

22285C(TP)
22244B(TP)

Figure 6–10. R-34A Receiver, A-f and I-f Printed Circuits, Wiring Diagram



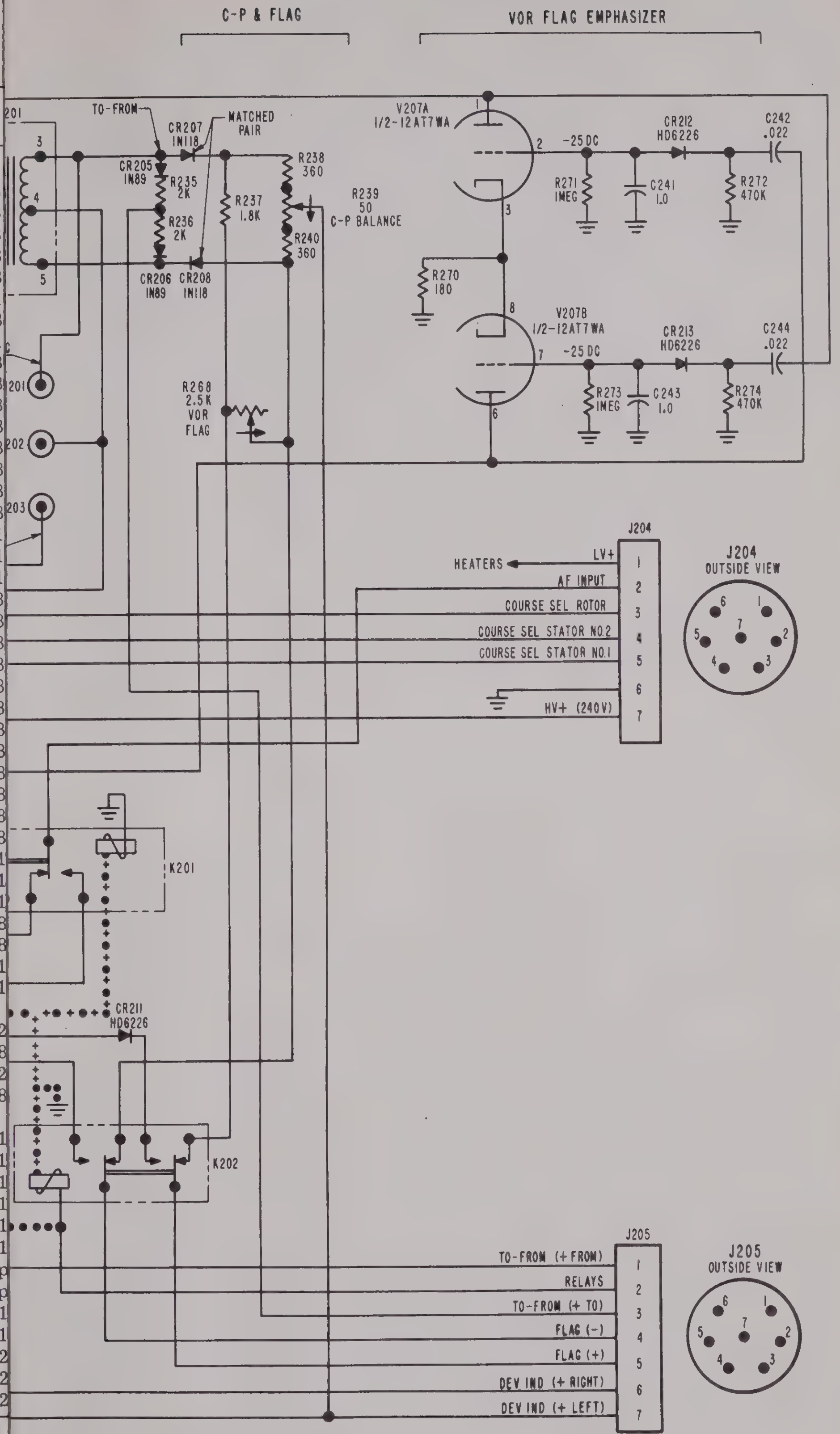
NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A3; FOR EXAMPLE, A3J1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.
3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2.
4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
5. DARK BAND ON CRYSTAL DIODES INDICATES END NEAREST COLOR CODING BANDS.

Figure 6–11. R-34A Receiver, Tuner Assembly, Wiring Diagram 23232B(TP)

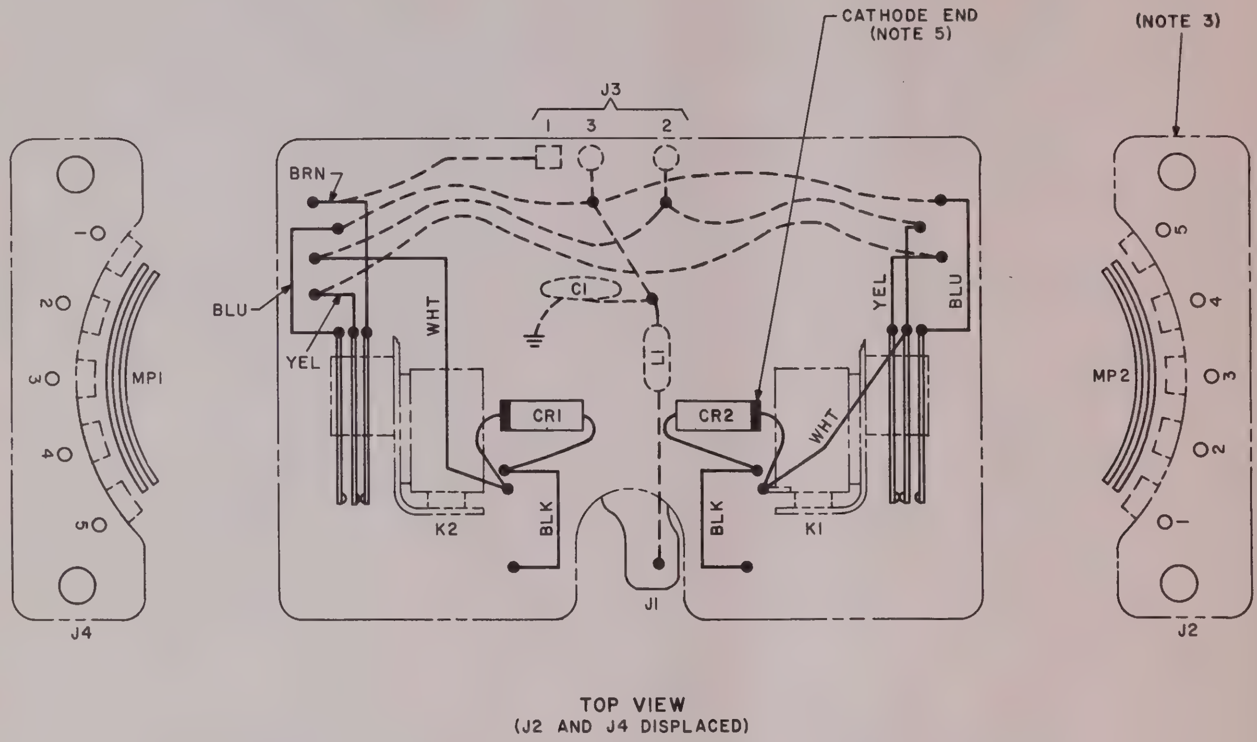
Reference Designation	
C201	8
C202	8
C203	8
C204	8
C205	8
C206	8
C207	1
C208	8
C209	1
C210	8
C211	8
C212	8
C213	8
C214	8
C215	8
C216	8
C217	8
C218	1
C219	1
C220	1
C221	8
C222	8
C223	8
C224	8
C225	8
C226	8
C227	8
C228	8
C229	8
C230	8
C231	8
C232	8
C233	1
C234	1
C235	1
C236	8
C237	8
C238	1
C239	1
C240	
C241	2
C242	8
C243	2
C244	8
CR201	1
CR202	1
CR203	1
CR204	1
CR205	1
CR206	1
CR207	p
CR208	p
CR209	1
CR210	1
CR211	2
CR212	2
CR213	2

[1]For 14-volt m
[2]For 28-volt m
[3]To complete p



22902C(TP)

Figure 6–12. B-13A-1 Converter, Schematic Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION, A3; FOR EXAMPLE, A3J1.

2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-1.

3. FOR RECEIVER WIRING DIAGRAM, SEE FIGURE 6-2.

4. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.

5. DARK BAND ON CRYSTAL DIODES INDICATES END NEAREST COLOR CODING BANDS.

23232B(TP)

Figure 6–11. R-34A Receiver, Tuner Assembly, Wiring Diagram

TABLE I. ARC PART NUMBERS

Reference Designation	ARC Part No.
C201	8617-0201
C202	8577
C203	8577
C204	8577
C205	8577
C206	8577
C207	13928
C208	8577
C209	13928
C210	8577
C211	8618-0362
C212	8577
C213	8577
C214	8577
C215	8577
C216	8577
C217	8577
C218	16143
C219	13928
C220	15763
C221	8577
C222	8577
C223	8577
C224	8577
C225	8618-0242
C226	8577
C227	8577
C228	8577
C229	8577
C230	8577
C231	8577
C232	8577
C233	15763
C234	16143
C235	16653
C236	8577
C237	8577
C238	16143
C239	16143
C240	—
C241	21485-9101
C242	8911-9223
C243	21485-9101
C244	8911-9223
CR201	16660
CR202	16660
CR203	16660
CR204	16660
CR205	16660
CR206	16660
CR207	p/o 16670
CR208	p/o 16670
CR209	16665
CR210	16665
CR211	23037
CR212	23037
CR213	23037

Reference Designation	ARC Part No.
J201	13152
J202	12921
J203	13152
J204	p/o 23114
J205	p/o 23114
K201	12712
K202	12712
R201	201-0105
R202	201-0162
R203	201-0513
R204	201-0622
R205	201-0224
R206	201-0104
R207	201-0622
R208	201-0514
R209	201-0911
R210	201-0105
R211	201-0513
R212	201-0513
R213	205-0334
R214	201-0510
R215	201-0152
R216	201-0513
R217	201-0513
R218	205-0105
R219	201-0103
R220	201-0103
R221	8578
R222	[3]201-*
R223	201-0105
R224	205-0104
R225	8247
R226	8573
R227	201-0152
R228	201-0104
R229	205-0036
R230	205-0017
R231	205-0036
R232	201-0105
R233	201-0182
R234	201-0512
R235	201-0202
R236	201-0202
R237	201-0182
R238	205-0361
R239	8654
R240	205-0361
R241	205-0474
R242	205-0514
R243	201-0205
R244	205-0105
R245	201-0182
R246	201-0104
R247	205-0036
R248	205-0017
R249	205-0036

Reference Designation	ARC Part No.
R250	8655
R251	201-0182
R252	201-0512
R253	201-0113
R254	204-0105
R255	205-0105
R256	201-0202
R257	8662
R258	204-0105
R259	205-0028
R260	201-0821
R261	201-0153
R262	201-0561
R264	8573
R265	201-0561
R266	[1]16643
R266	[2]16644
R267	202-0511
R268	8915-0252
R269	8915-0252
R270	201-0181
R271	201-0105
R272	201-0474
R273	201-0105
R274	201-0474
T201	15610
T202	15610
V201	700-0120
V202	700-0218
V203	700-0120
V204	700-0120
V205	700-0125
V206	700-0128
V207	700-0173
XV201	15230
XV203	15230
XV204	15230
XV205	15230
XV206	15230
XV207	15230
Z201	15374
Z202	15890
Z203	15891

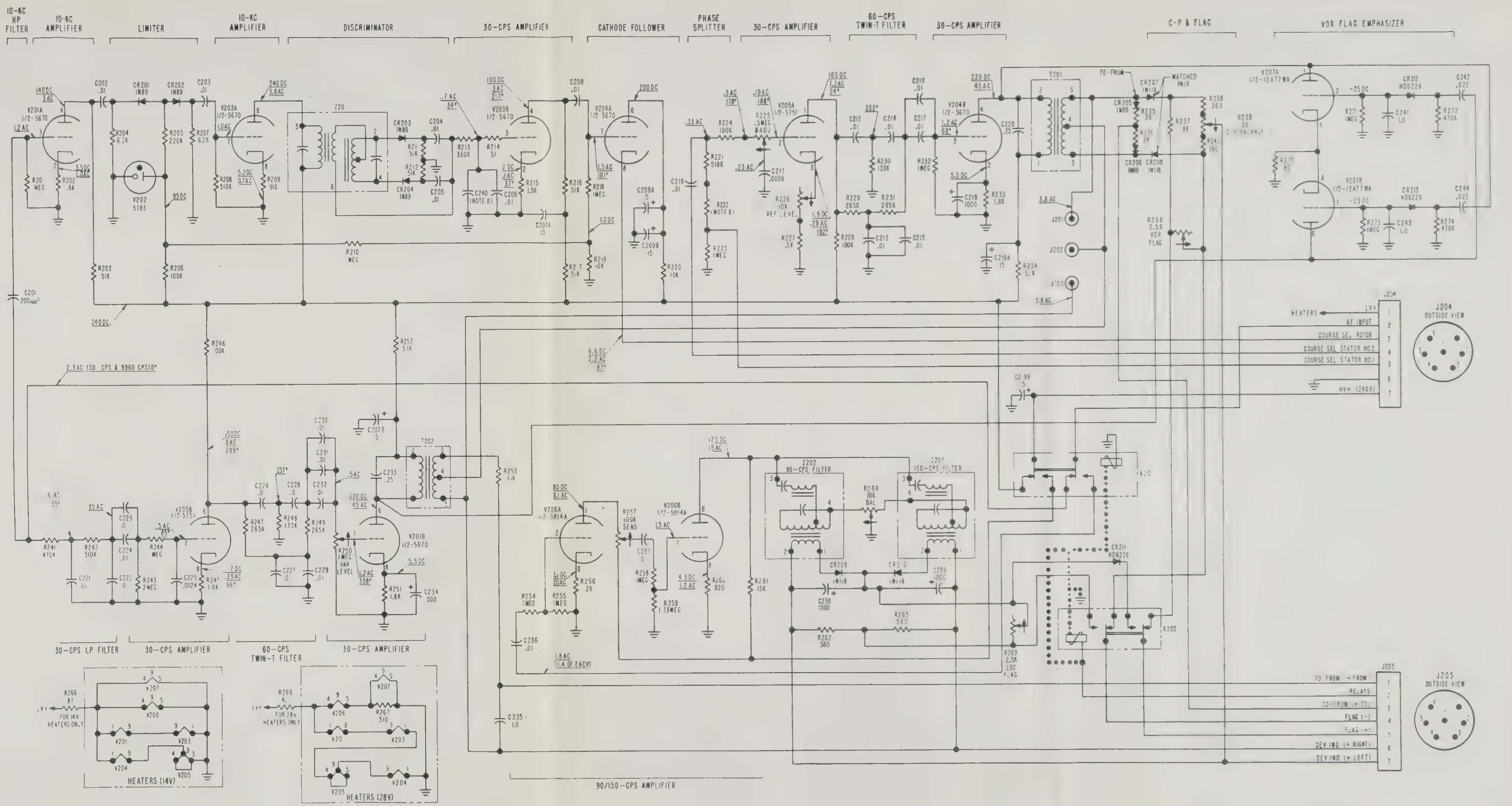
[1]For 14-volt model.
[2]For 28-volt model.
[3]To complete part number, insert value in place of asterisk.

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-13.
2. CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE NOTED.
3. RESISTOR VALUES ARE IN OHMS; MULTIPLIERS K=1,000 AND MEG=1,000,000.
4. FOR 28-VOLT UNITS, WIRES MARKED (+ + + +) ARE CONNECTED AND WIRES MARKED (. . . .) ARE OMITTED.
5. FOR 14-VOLT UNITS, WIRES MARKED (. . . .) ARE CONNECTED AND WIRES MARKED (+ + + +) ARE OMITTED.
6. A-C AND D-C VOLTAGES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS:
   A. D-C VOLTAGES ARE OBTAINED WITH A 20,000 OHMS-PER-VOLT VOLTMETER AND WITH LV+ SET AT THE NOMINAL SUPPLY VOLTAGE OF 14 VOLTS OR 28 VOLTS. VOLTAGES WILL BE SLIGHTLY HIGHER FOR 28-VOLT UNITS THAN FOR 14-VOLT UNITS.
   B. A-C VOLTAGES ARE OBTAINED WITH A BALLANTINE MODEL 300 ELECTRONIC VOLTMETER. VOLTAGES ARE MEASURED TO GROUND WITH THE EXCEPTION OF T201 AND T202 SECONDARY VOLTAGES WHICH ARE MEASURED TO COMMON CENTER TAP.
7. ARROWS ON GERMANIUM DIODES SHOW DIRECTION OF CURRENT FLOW.
8. VALUES OF THE FOLLOWING PARTS ARE SELECTED AND INSTALLED AT TIME OF FINAL ADJUSTMENT:

SYMBOL NO.	LIMITING VALUE	PURPOSE
R222	0-20K	MINIMIZE QUADRANTAL ERROR
C240	0-0.002 μF	CENTER PHASE ADJUSTING CONTROL

9. RELATIVE PHASE ANGLES OF VARIOUS 30-CPS VOLTAGES ARE MEASURED WITH RESPECT TO THE A-F INPUT VOLTAGE WITH THE COURSE SELECTOR SET FOR A 191° ON-COURSE (TO) INDICATION.

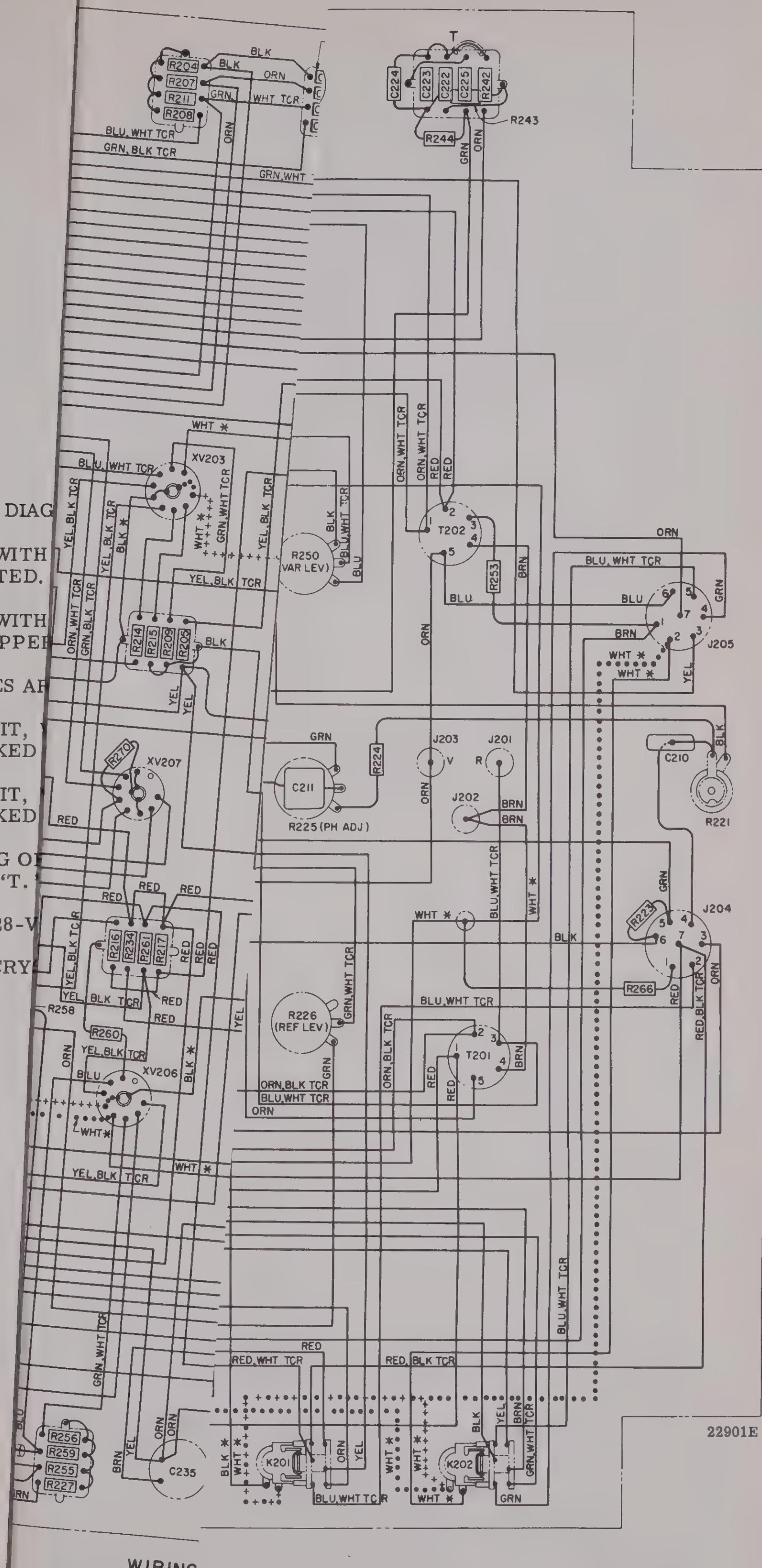


22902C(TP)

Figure 6–12. B-13A-1 Converter, Schematic Diagram

NOTES:

1. FOR SCHEMATIC DIAG
2. WIRES MARKED WITH TEFLON INSULATED.
3. WIRES MARKED WITH NO. 22 SOLID COPPE
4. UNMARKED WIRES AI
5. FOR 28-VOLT UNIT, AND WIRES MARKED
6. FOR 14-VOLT UNIT, AND WIRES MARKED
7. VINYLITE TUBING OI WIRES MARKED "T.
8. R267 IS USED IN 28-V
9. DARK BAND ON CRY CODING BANDS.

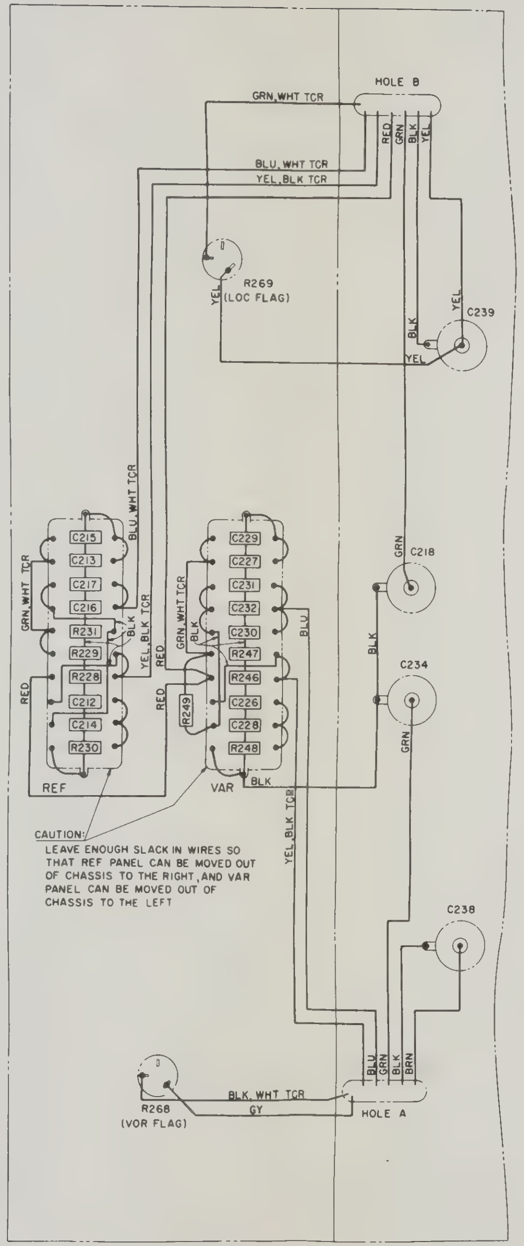


WIRING

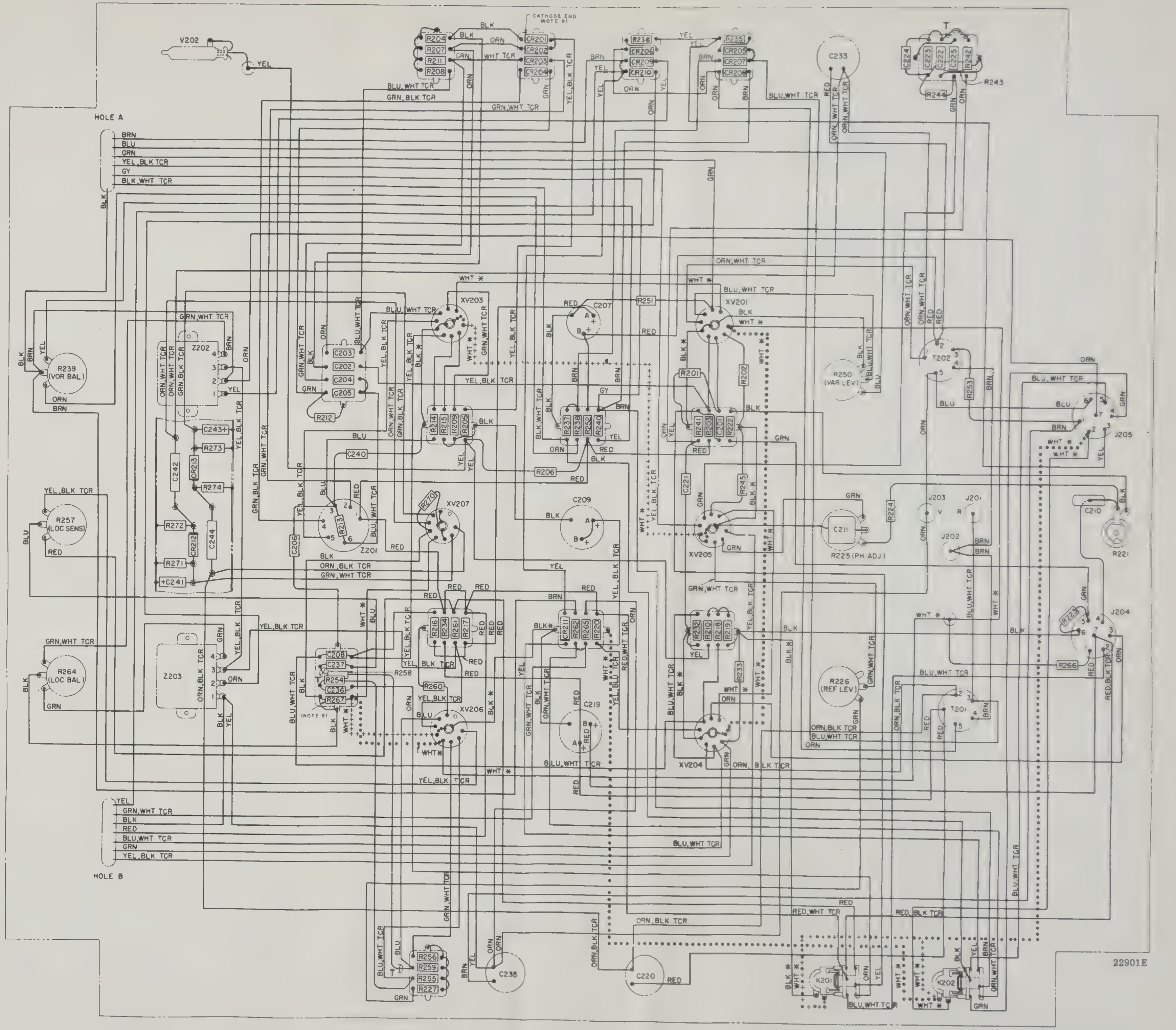
13. B-13A-1 Converter, Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-12.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 SOLID COPPER, TEFLON INSULATED.
4. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
5. FOR 28-VOLT UNIT, WIRES MARKED (+ + + +) ARE CONNECTED AND WIRES MARKED (. . . .) ARE OMITTED.
6. FOR 14-VOLT UNIT, WIRES MARKED (. . . .) ARE CONNECTED AND WIRES MARKED (+ + + +) ARE OMITTED.
7. VINYLITE TUBING OF APPROPRIATE SIZE IS INSTALLED OVER WIRES MARKED "T."
8. R267 IS USED IN 28-VOLT UNITS ONLY.
9. DARK BAND ON CRYSTAL DIODE INDICATES END NEAREST COLOR CODING BANDS.



WIRING ABOVE TUBE DECK



WIRING BELOW TUBE DECK

Figure 6–13. B-13A-1 Converter, Wiring Diagram

NOTES:

1. FOR WIRING DI

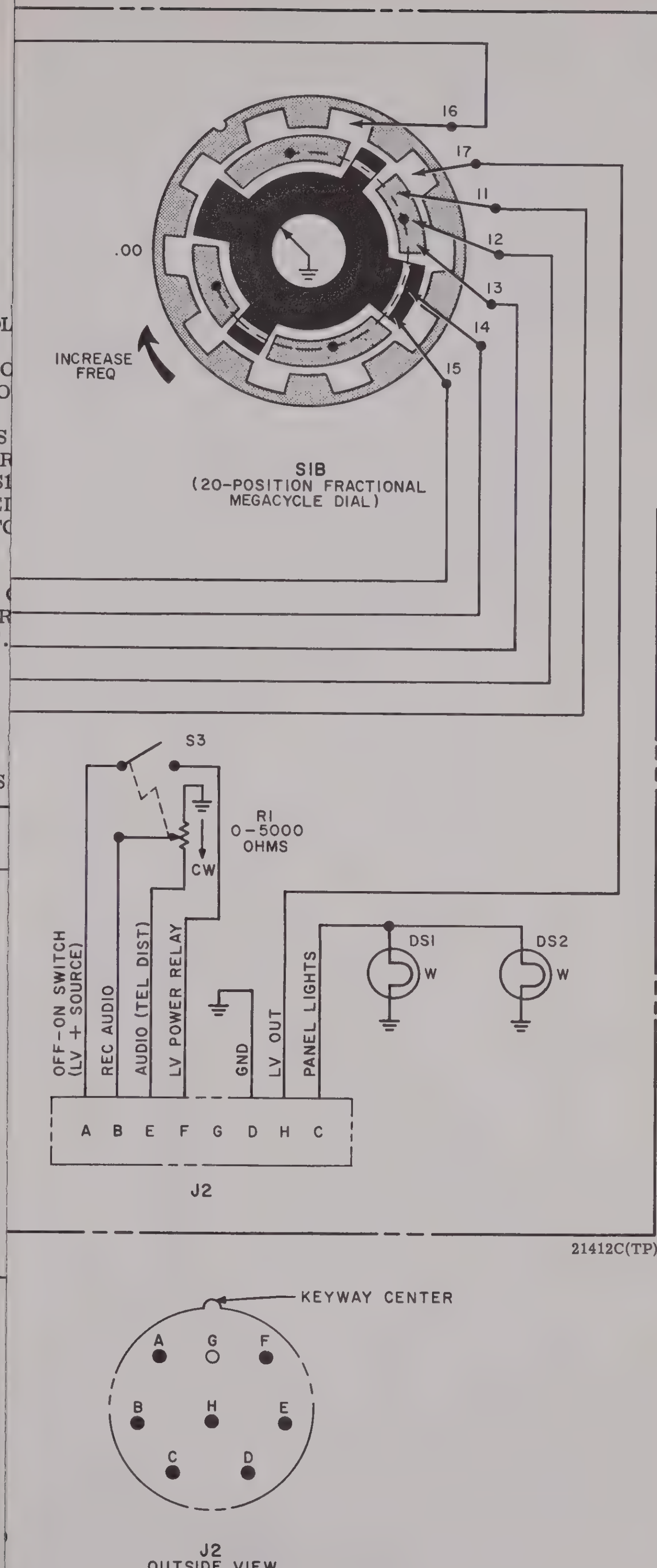
2. SWITCH SECTIC
IDENTIFICATIO

3. S1A CONTROLS
CONTROLS TER
POSITION OF S1
ARE GROUNDEI
CONNECTED TC
II.

4. TERMINALS M (
FREE FROM GR
(.10, .30, ETC.

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	8679
DS1(28V)	8622
DS2(14V)	8679
DS2(28V)	8622
J1	12357
J2	12097
R1	23115
R2	23738
S1A	21689
S1B	21697
S3	23115
XDS1	16293
XDS2	16293



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THER

Figure 6–14. C-81A Control Unit, Schematic Diagram

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-15.

2. SWITCH SECTIONS S1A AND S1B ARE SHOWN AT 108.00 MC. FOR IDENTIFICATION OF SWITCH TERMINALS, SEE FIGURE 6-15.

3. S1A CONTROLS TERMINAL GROUP H, I, J, K, L OF J1. S1B CONTROLS TERMINAL GROUP N, O, P, Q, R OF J1. AT EACH POSITION OF S1A AND S1B CERTAIN TERMINALS IN EACH GROUP ARE GROUNDED AND THE OTHER TERMINALS IN THE GROUP ARE CONNECTED TOGETHER FREE FROM GROUND. REFER TO TABLE II.

4. TERMINALS M OF J1 AND H OF J2 ARE CONNECTED TOGETHER FREE FROM GROUND AT ODD-TENTH POSITIONS OF S1B (.10, .30, ETC.).

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	8679
DS1(28V)	8622
DS2(14V)	8679
DS2(28V)	8622
J1	12357
J2	12097
R1	23115
R2	23738
S1A	21689
S1B	21697
S3	23115
XDS1	16293
XDS2	16293

TABLE II
TABULATION OF GROUNDED TERMINALS IN EACH GROUP
(NOTE 3)

S1A	J1 Terminal Group H, I, J, K, L	S1B	J1 Terminal Group N, O, P, Q, R
108	L, K	.00	N, O
109	L, K, J	.10	N, R
110	L, H	.20	Q
111	L, K, J, I	.30	P
112	I	.40	O
113	K, J, I, H	.50	N
114	J	.60	R
115	L, J, I, H	.70	Q, R
116	K	.80	P, Q
117	K, I, H	.90	O, P
118	L	.00	N, O
119	L, J, H	.10	N, R
120	H	.20	Q
121	K, I	.30	P
122	I, H	.40	O
123	J, H	.50	N
124	J, I	.60	R
125	L, I	.70	Q, R
126	K, J	.80	P, Q
Space	L, K, H	.90	O, P

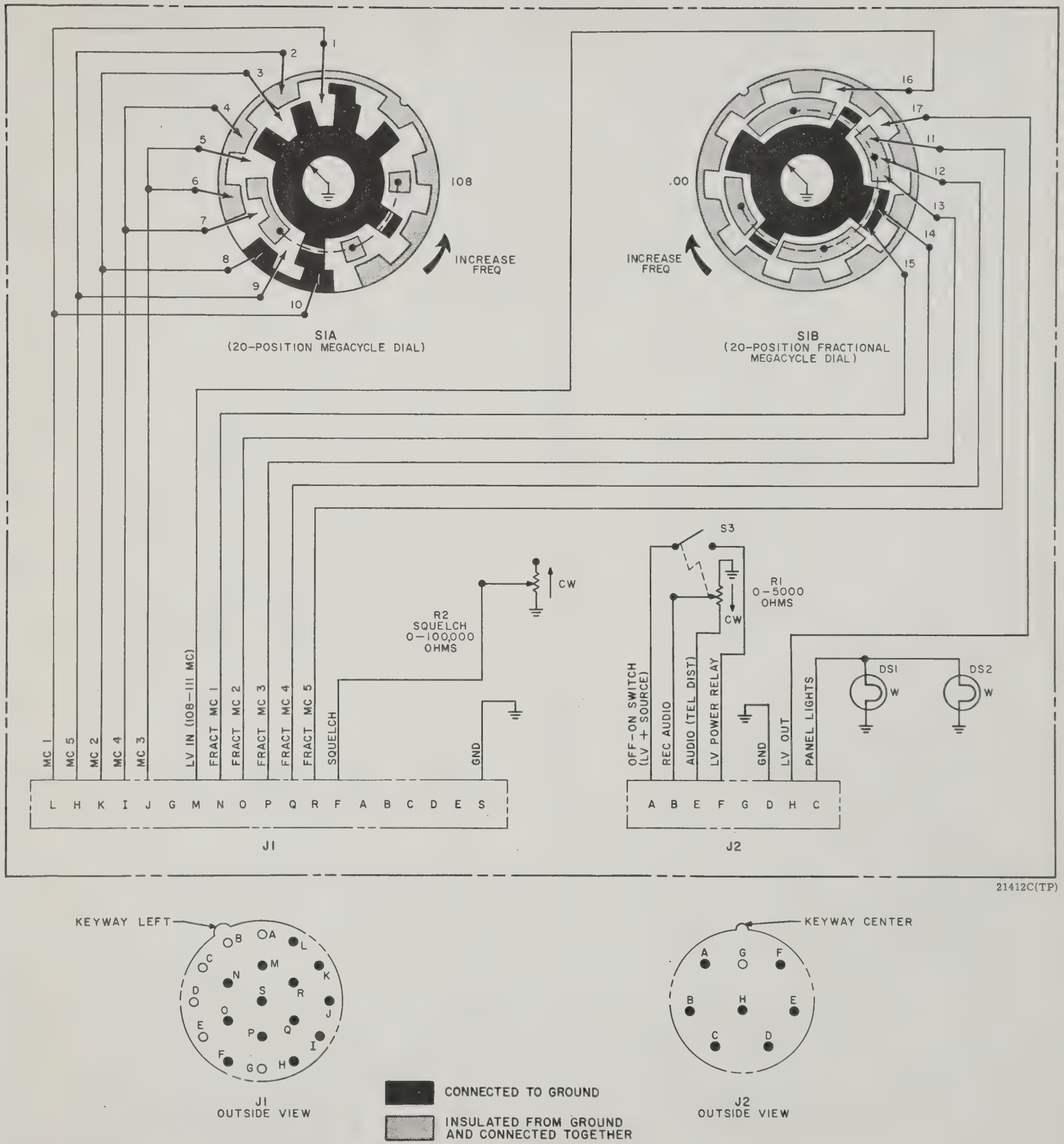
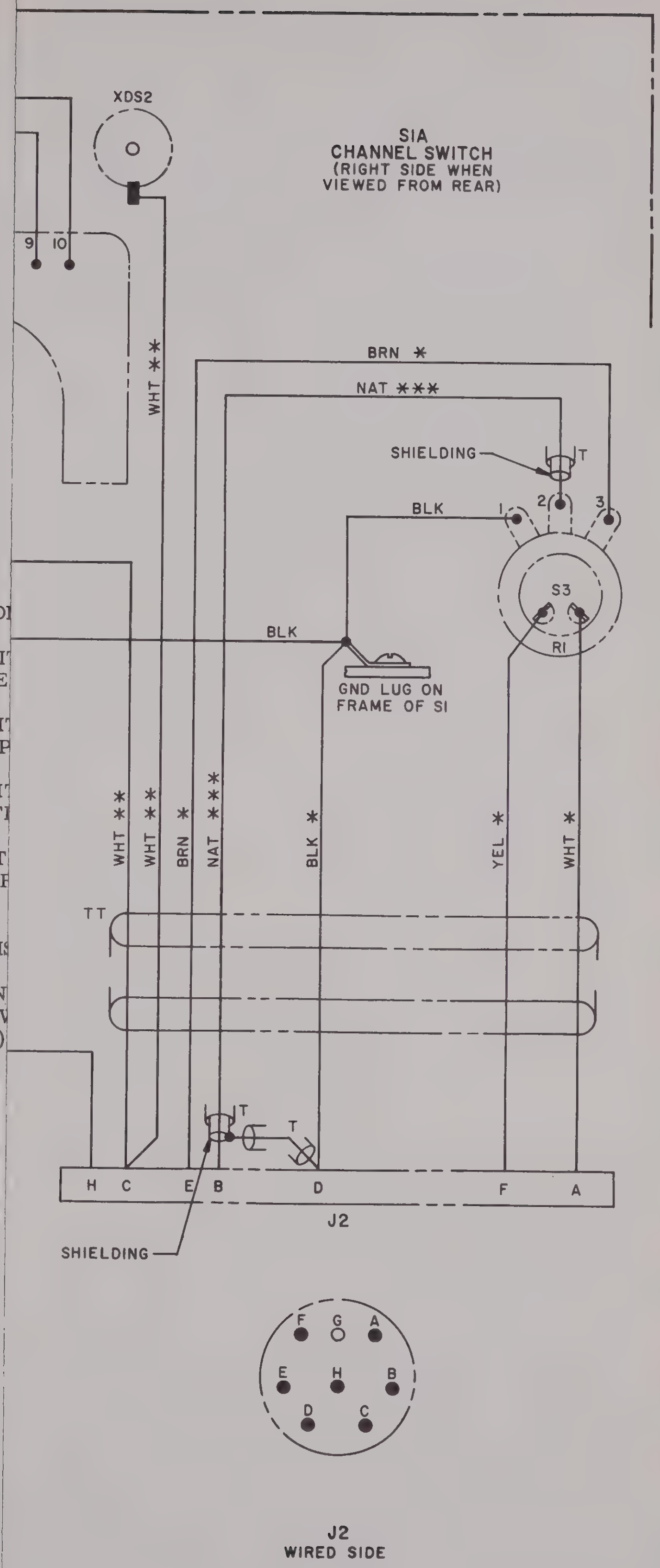


Figure 6–14. C-81A Control Unit, Schematic Diagram



NOTES:

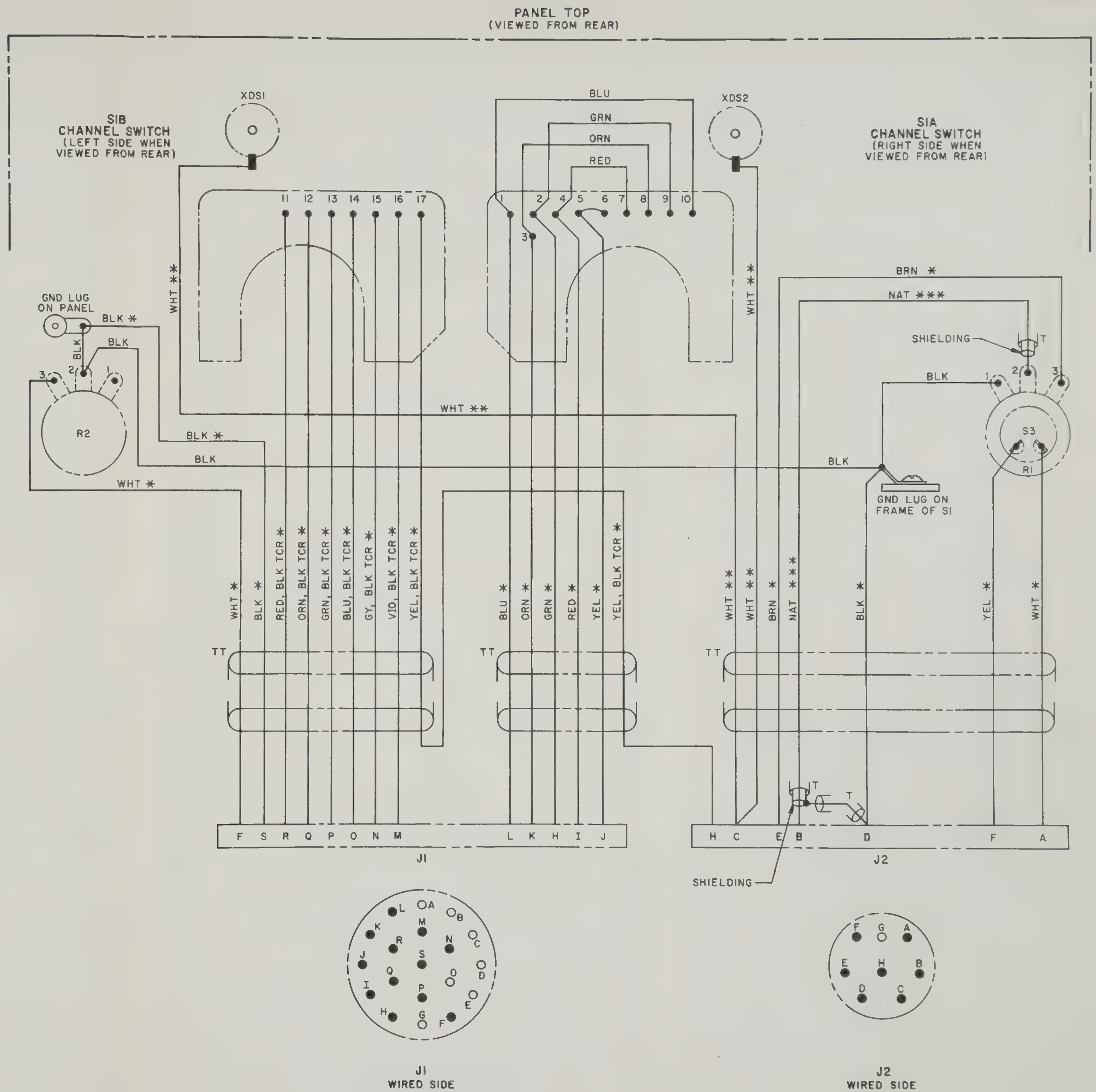
1. FOR SCHEMATIC DI
2. WIRES MARKED WIT
   TEFLON INSULATE
3. WIRES MARKED WIT
   NO. 22 SOLID COPP
4. WIRES MARKED WIT
   (**) ARE NO. 20 STI
5. WIRE MARKED WIT
   STRANDED COPPEI
   COPPER SHIELD.
6. UNMARKED WIRE IS
7. TRANSPARENT VIN
   OVER GROUPS OF V
   TUBING (1/8" I. D.)
   MARKED "TT."

21411B(TP)

Figure 6–15. C-81A Control Unit, Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-14.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 SOLID COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A COLOR NOTE AND A DOUBLE ASTERISK (**) ARE NO. 20 STRANDED COPPER, TEFLON INSULATED.
5. WIRE MARKED WITH A TRIPLE ASTERISK (***) IS NO. 22 STRANDED COPPER, TEFLON INSULATED WITH BRAIDED COPPER SHIELD.
6. UNMARKED WIRE IS NO. 24 BARE, SOLID, TINNED COPPER.
7. TRANSPARENT VINYLITE TUBING (1/8" I. D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "T." NYLON SPIRAL-CUT TUBING (1/8" I. D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "TT."



21411B(TP)

Figure 6–15. C-81A Control Unit, Wiring Diagram

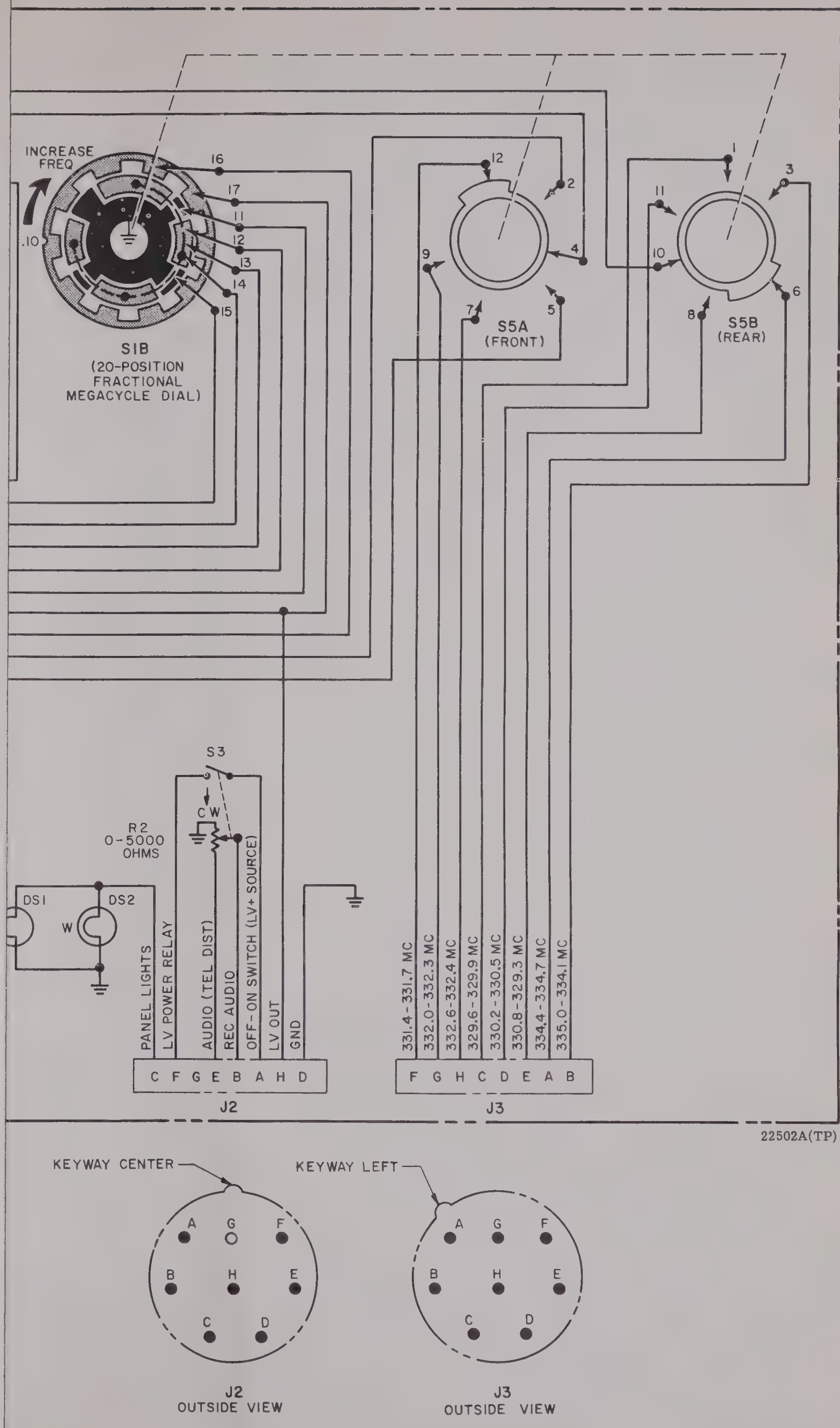


Figure 6–16. C-88A Control Unit, Schematic Diagram

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-17.
2. SWITCH SECTIONS S1A AND S1B ARE SHOWN AT 108.00 MC. FOR IDENTIFICATION OF SWITCH TERMINALS SEE FIGURE 6-17.
3. S1A CONTROLS TERMINAL GROUP H, I, J, K, L OF J1. S1B CONTROLS TERMINAL GROUP N, O, P, Q, R OF J1. AT EACH POSITION OF S1A AND S1B CERTAIN TERMINALS IN EACH GROUP ARE GROUNDED AND THE OTHER TERMINALS IN THE GROUP ARE CONNECTED TOGETHER FREE FROM GROUND. REFER TO TABLE II.
4. TERMINALS D AND M OF J1 AND H OF J2 ARE CONNECTED TOGETHER FREE FROM GROUND AT ODD-TENTH POSITIONS OF S1B (.10, .30, ETC.).
5. SWITCH S4 (A & B) IS SHOWN AT 108 MC AND IS CONTROLLED BY THE MEGACYCLE DIAL. GROUNDED TERMINALS ARE SHOWN IN TABLE III. SWITCH S5 (A & B) IS SHOWN AT .10 MC AND IS CONTROLLED BY THE FRACTIONAL MEGACYCLE DIAL. GROUNDED TERMINALS ARE SHOWN IN TABLE III.

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	8679
DS1(28V)	8622
DS2(14V)	8679
DS2(28V)	8622
J1	12357
J2	12097
J3	12355
R1	23738
R2	23115
S1A	21689
S1B	21697
S3	23115
S4	23729
S5	23728
XDS1	16293
XDS2	16293

TABLE II
TABULATION OF GROUNDED TERMINALS IN EACH GROUP
(SWITCH S1)

S1A	J1 Terminal Group H, I, J, K, L	S1B	J1 Terminal Group N, O, P, Q, R
108	L, K	.00	N, O
109	L, K, J	.10	N, R
110	L, H	.20	Q
111	L, K, J, I	.30	P
112	I	.40	O
113	K, J, I, H	.50	N
114	J	.60	R
115	L, J, I, H	.70	Q, R
116	K	.80	P, Q
117	K, I, H	.90	O, P
118	L	.00	N, O
119	L, J, H	.10	N, R
120	H	.20	Q
121	K, I	.30	P
122	I, H	.40	O
123	J, H	.50	N
124	J, I	.60	R
125	L, I	.70	Q, R
126	K, J	.80	P, Q
Space	L, K, H	.90	O, P

TABLE III. TABULATION OF GROUNDED TERMINALS
(SWITCHES S4 & S5)

S4 (A & B) and S5 (A & B)	Grounded Terminals for Paired Glide Slope Frequency		Paired Glide Slope Frequency MC
	J3	J1	
108.10	A	C	334.7
108.30	B	C	334.1
108.50	C	C	329.9
108.70	D	C	330.5
108.90	E	C	329.3
109.10	F		331.4
109.30	G		332.0
109.50	H		332.6
109.70		A	333.2
109.90		B	333.8
110.10	A		334.4
110.30	B		335.0
110.50	C		329.6
110.70	D		330.2
110.90	E		330.8
111.10	F	C	331.7
111.30	G	C	332.3
111.50	H	C	332.9
111.70		A, C	333.5
111.90		B, C	331.1

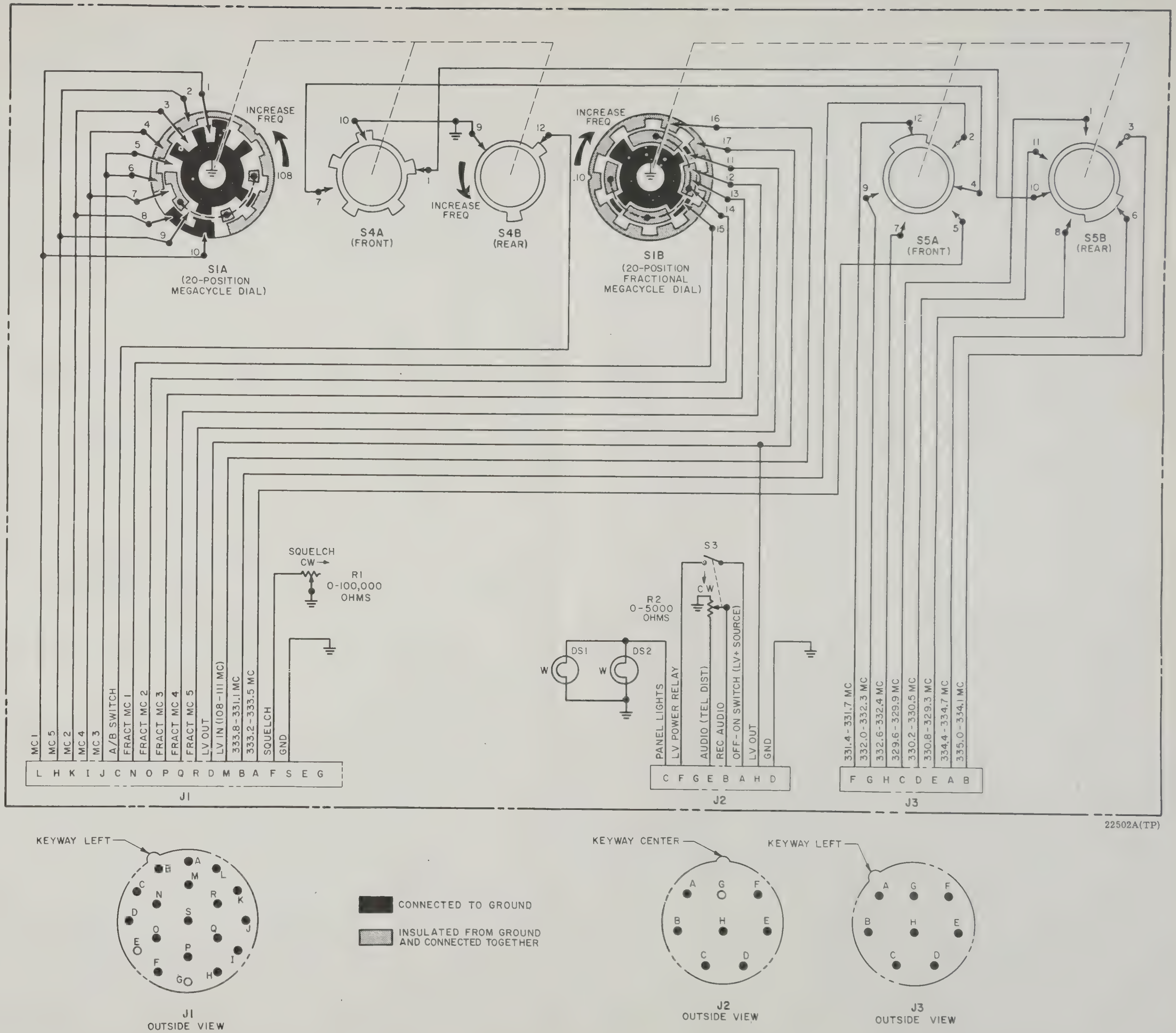
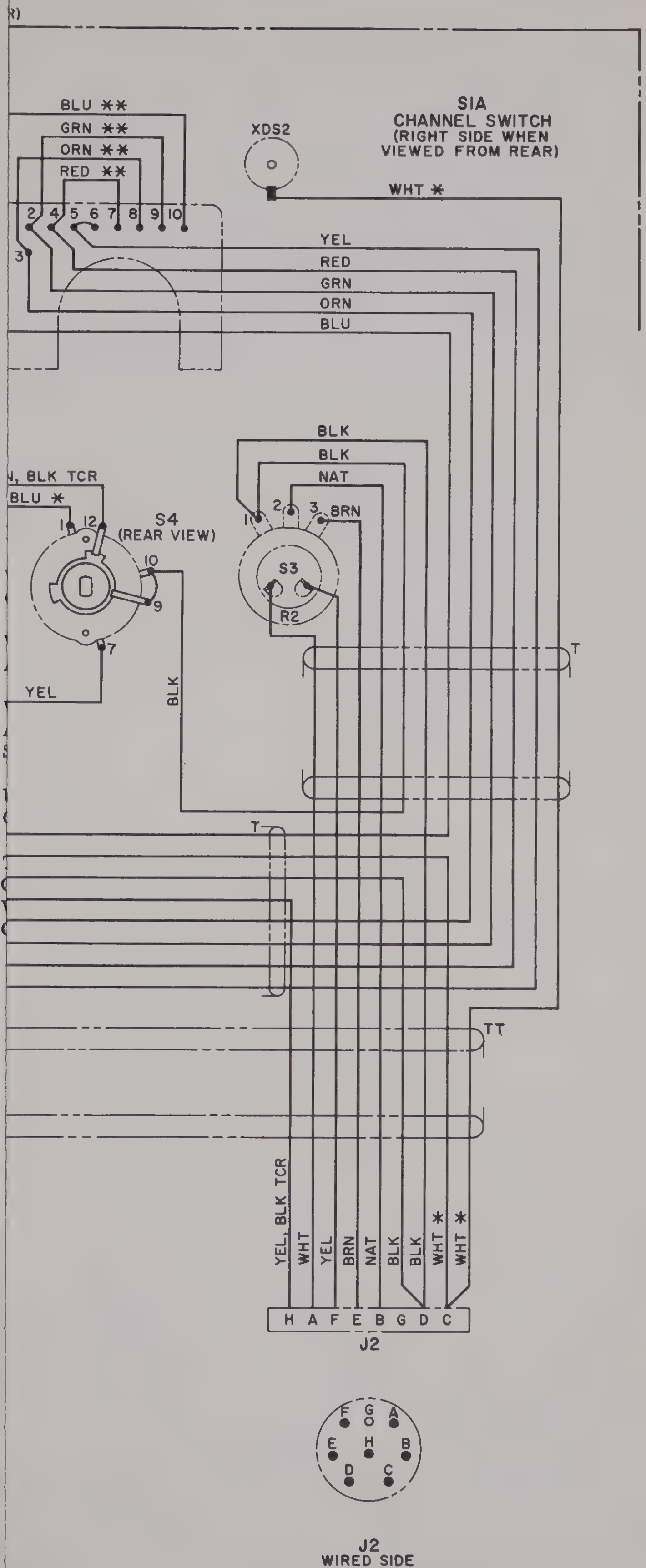


Figure 6–16. C-88A Control Unit, Schematic Diagram



NOTES:

1.

2.

3.

4.

5.

6.

22501A(TP)

Figure 6–17. C-88A Control Unit, Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-16.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 SOLID COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A COLOR NOTE AND A DOUBLE ASTERISK (**) ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
6. TRANSPARENT VINYLITE TUBING (0.258 I.D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "T." TRANSPARENT VINYLITE TUBING (0.313 I.D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "TT."

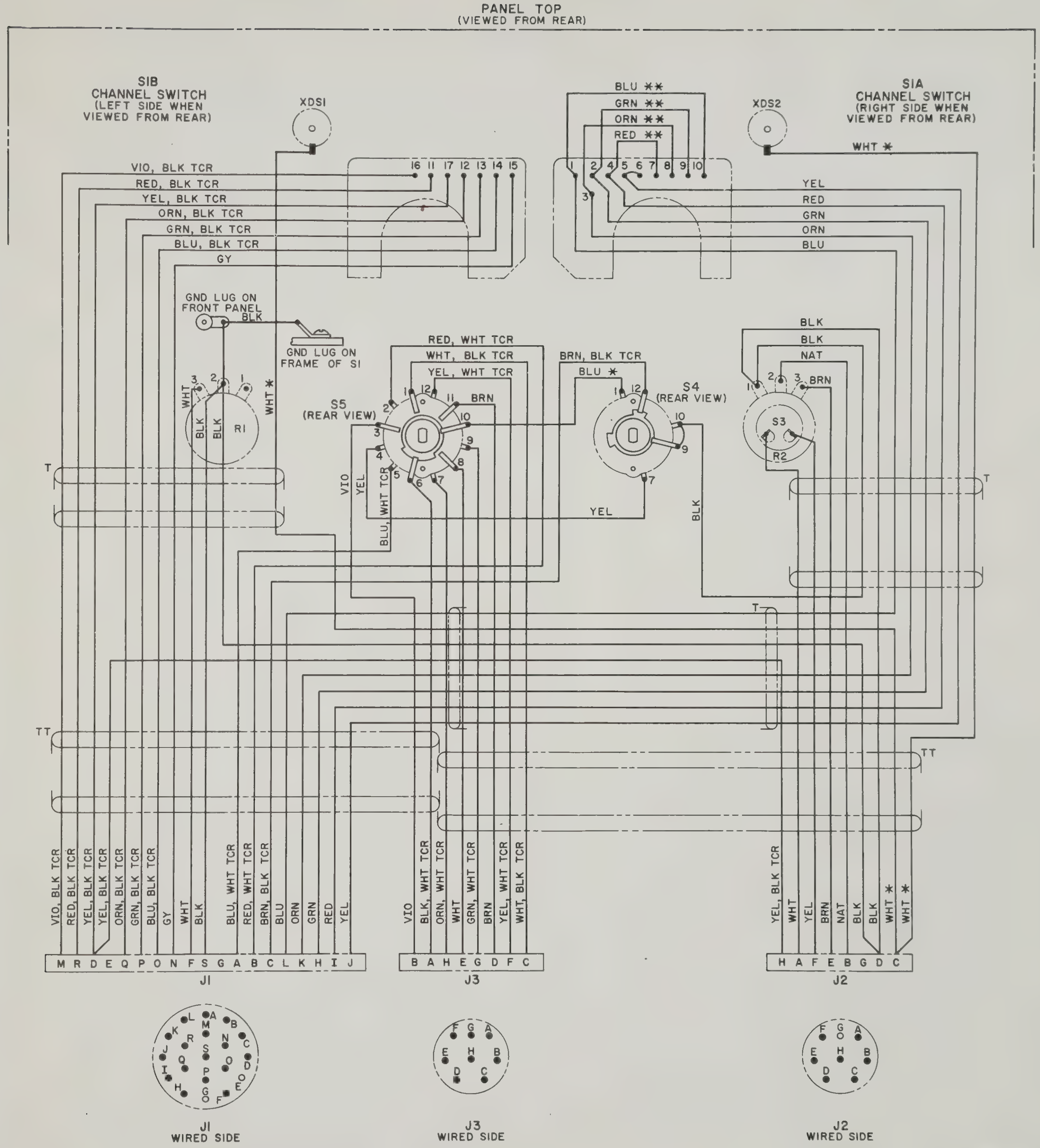


Figure 6–17. C-88A Control Unit, Wiring Diagram

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	8679
DS1(28V)	8622
DS2(14V)	8679
DS2(28V)	8622
S1A	21689
S1B	21697
TB1	24023
XDS1	23861
XDS2	23861

TABLE II
TABULATION OF GROUNDED TERMINALS IN EACH GROUP
(NOTE 3)

S1A	TB1 Terminal Group G, H, J, K, L	S1B	TB1 Terminal Group N, O, P, Q, R
108	L, K	.00	N, O
109	L, K, J	.10	N, R
110	L, H	.20	Q
111	L, K, J, G	.30	P
112	G	.40	O
113	K, J, H, G	.50	N
114	J	.60	R
115	L, J, H, G	.70	Q, R
116	K	.80	P, Q
117	K, H, G	.90	O, P
118	L	.00	N, O
119	L, J, H	.10	N, R
120	H	.20	Q
121	K, G	.30	P
122	H, G	.40	O
123	J, H	.50	N
124	J, G	.60	R
125	L, G	.70	Q, R
126	K, J	.80	P, Q
Space	L, K, H	.90	O, P

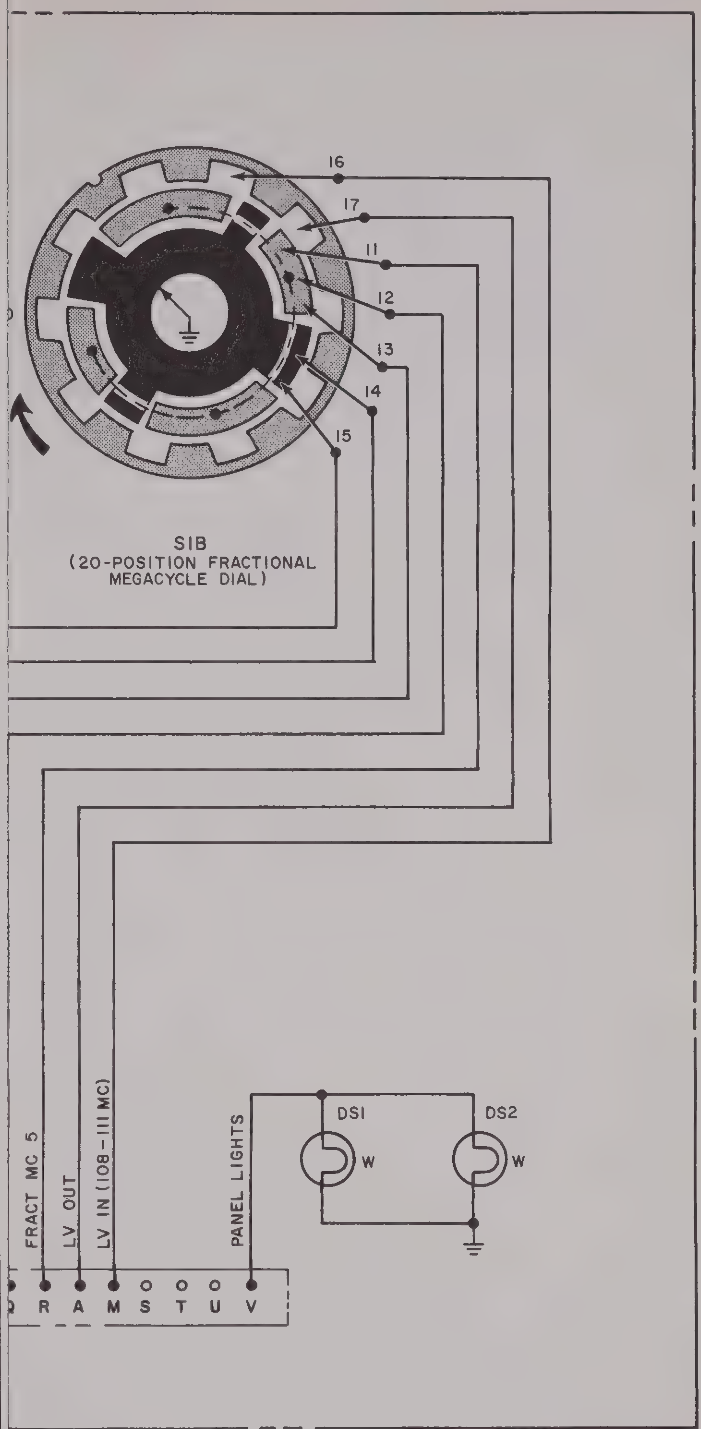


Figure 6–18. CC-11A Custom Control Unit, Schematic Diagram

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	8679
DS1(28V)	8622
DS2(14V)	8679
DS2(28V)	8622
S1A	21689
S1B	21697
TB1	24023
XDS1	23861
XDS2	23861

TB1
(OUTSIDE VIEWS)

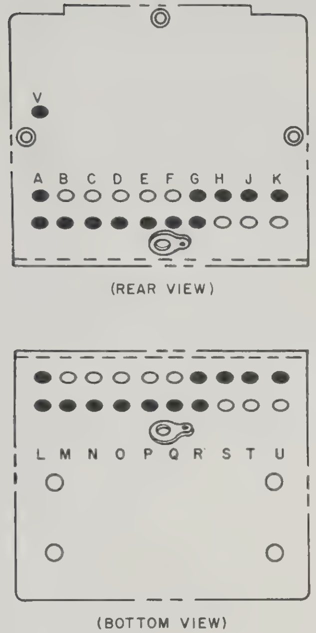
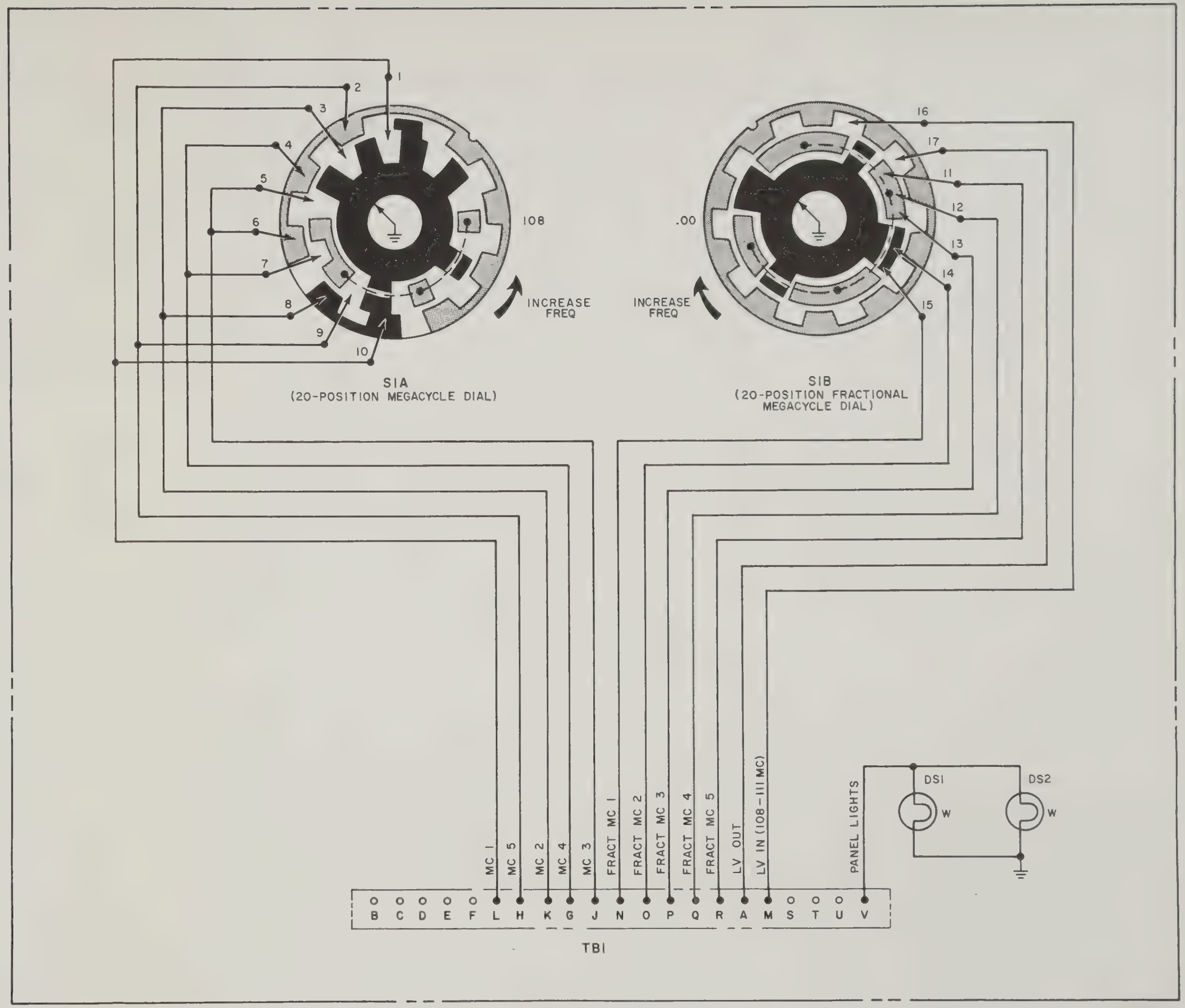


TABLE II
TABULATION OF GROUNDED
TERMINALS IN EACH GROUP
(NOTE 3)

S1A	TB1 Terminal Group G, H, J, K, L	S1B	TB1 Terminal Group N, O, P, Q, R
108	L, K	.00	N, O
109	L, K, J	.10	N, R
110	L, H	.20	Q
111	L, K, J, G	.30	P
112	G	.40	O
113	K, J, H, G	.50	N
114	J	.60	R
115	L, J, H, G	.70	Q, R
116	K	.80	P, Q
117	K, H, G	.90	O, P
118	L	.00	N, O
119	L, J, H	.10	N, R
120	H	.20	Q
121	K, G	.30	P
122	H, G	.40	O
123	J, H	.50	N
124	J, G	.60	R
125	L, G	.70	Q, R
126	K, J	.80	P, Q
Space	L, K, H	.90	O, P

CONNECTED TO GROUND

INSULATED FROM GROUND AND CONNECTED TOGETHER

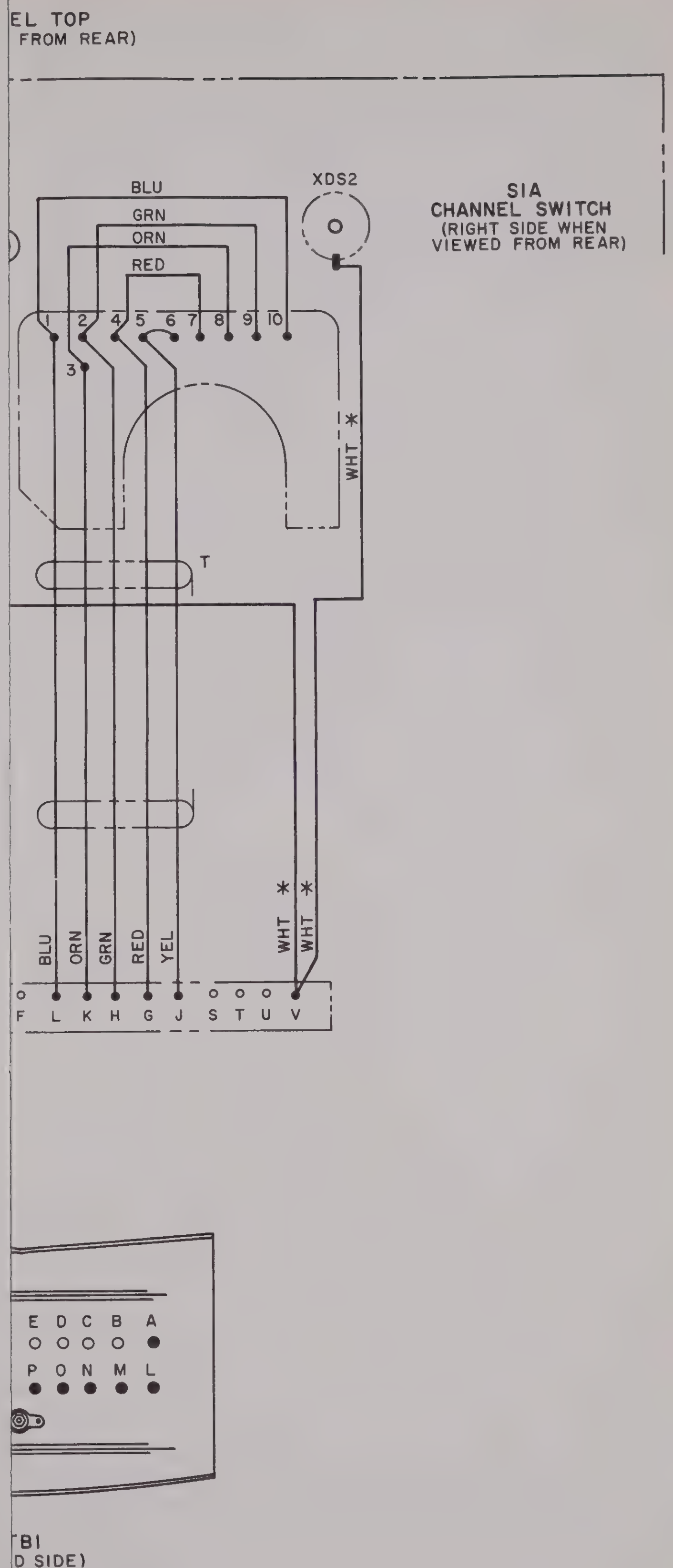


24032A(TP)

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-19.
2. SWITCH SECTIONS S1A AND S1B ARE SHOWN AT 108.00 MC. FOR IDENTIFICATION OF SWITCH TERMINALS, SEE FIGURE 6-19.
3. S1A CONTROLS TERMINAL GROUP G, H, J, K, L. S1B CONTROLS TERMINAL GROUP N, O, P, Q, R. AT EACH POSITION OF S1A AND S1B CERTAIN TERMINALS IN EACH GROUP ARE GROUNDED AND THE OTHER TERMINALS IN THE GROUP ARE CONNECTED TOGETHER FREE FROM GROUND. REFER TO TABLE II.
4. TERMINALS M AND H ARE CONNECTED TOGETHER FREE FROM GROUND AT ODD-TENTH POSITIONS OF S1B (.10, .30, ETC.).

Figure 6–18. CC-11A Custom Control Unit, Schematic Diagram

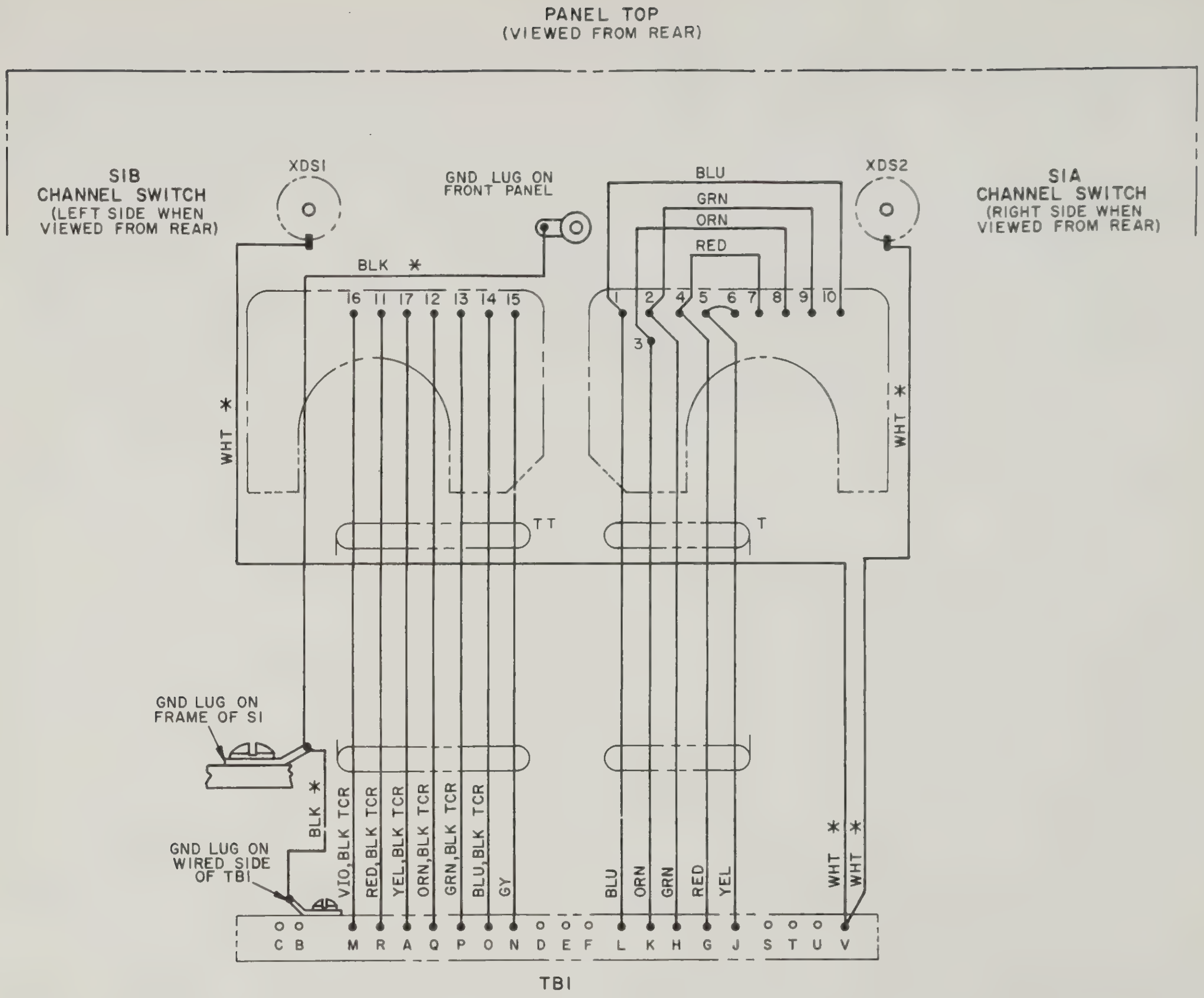


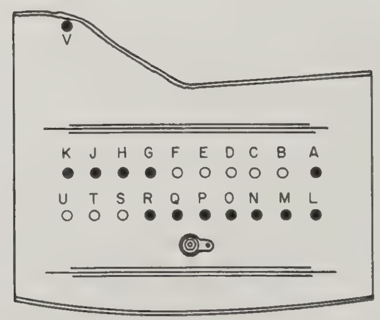
24031A

Figure 6–19. CC-11A Custom Control Unit, Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-18.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 SOLID COPPER, TEFLON INSULATED.
4. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
5. TRANSPARENT VINYLITE TUBING (0.129 I.D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "T." TRANSPARENT VINYLITE TUBING (0.258 I.D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "TT."





TB1
(WIRED SIDE)

24031A

Figure 6–19. **CC-11A** *Custom Control Unit, Wiring Diagram*

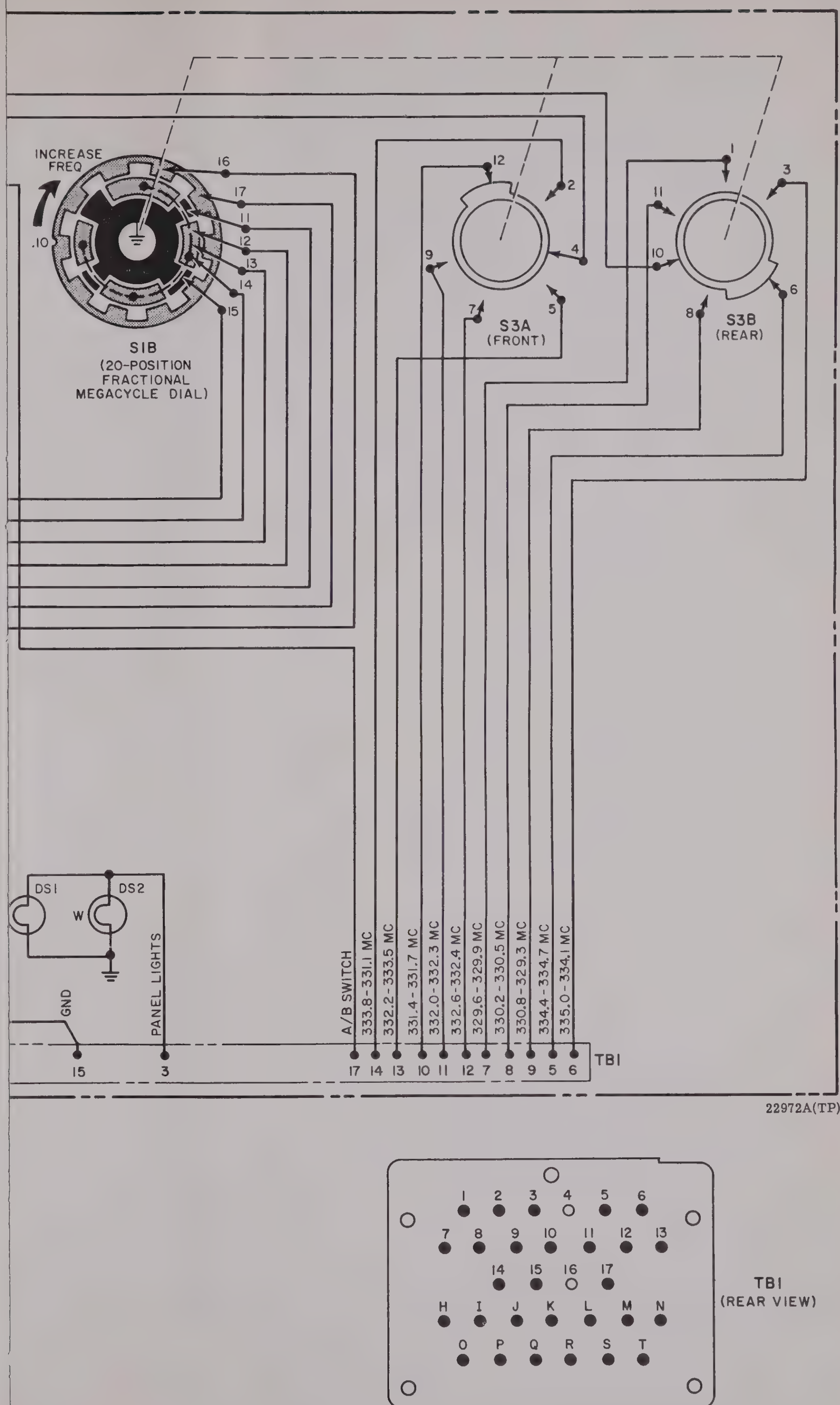


Figure 6–20. CC-12A Custom Control Unit, Schematic Diagram

NOTES:
1. FOR WIRING DIAGRAM, SEE FIGURE 6-21.
2. SWITCH SECTIONS S1A AND S1B ARE SHOWN AT 108.00 MC. FOR IDENTIFICATION OF SWITCH TERMINALS, SEE FIGURE 6-21.
3. S1A CONTROLS TERMINAL GROUP H, I, J, K, L. S1B CONTROLS TERMINAL GROUP N, O, P, Q, R. AT EACH POSITION OF S1A AND S1B CERTAIN TERMINALS IN EACH GROUP ARE GROUNDED AND THE OTHER TERMINALS IN THE GROUP ARE CONNECTED TOGETHER FREE FROM GROUND. REFER TO TABLE II.
4. TERMINALS 2, M, AND T ARE CONNECTED TOGETHER FREE FROM GROUND AT ODD-TENTH POSITIONS OF S1B (.10, .30, ETC.).
5. SWITCH S2 (A & B) IS SHOWN AT 108 MC AND IS CONTROLLED BY THE MEGACYCLE DIAL. GROUNDED TERMINALS ARE SHOWN IN TABLE III. SWITCH S3 (A & B) IS SHOWN AT .10 MC AND IS CONTROLLED BY THE FRACTIONAL MEGACYCLE DIAL. GROUNDED TERMINALS ARE SHOWN IN TABLE III.

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
DS1(14V)	21760
DS1(28V)	8622
DS2(14V)	21760
DS2(28V)	8622
S1A	21689
S1B	21697
S2	23729
S3	23728
TB1	23846
XDS1	23861
XDS2	23861

TABLE II
TABULATION OF GROUNDED TERMINALS IN EACH GROUP
(SWITCH S1)

S1A	TB1 Terminal Group H, I, J, K, L	S1B	TB1 Terminal Group N, O, P, Q, R
108	L, K	.00	N, O
109	L, K, J	.10	N, R
110	L, H	.20	Q
111	L, K, J, I	.30	P
112	I	.40	O
113	K, J, I, H	.50	N
114	J	.60	R
115	L, J, I, H	.70	Q, R
116	K	.80	P, Q
117	K, I, H	.90	O, P
118	L	.00	N, O
119	L, J, H	.10	N, R
120	H	.20	Q
121	K, I	.30	P
122	I, H	.40	O
123	J, H	.50	N
124	J, I	.60	R
125	L, I	.70	Q, R
126	K, J	.80	P, Q
Space	L, K, H	.90	O, P

TABLE III. TABULATION OF GROUNDED TERMINALS
(SWITCHES S2 & S3)

S2 (A & B) and S3 (A & B)	TB1 Grounded Terminals for Paired Glide Slope Frequency	Paired Glide Slope Frequency MC
108.10	5, 17	334.7
108.30	6, 17	334.1
108.50	7, 17	329.9
108.70	8, 17	330.5
108.90	9, 17	329.3
109.10	10	331.4
109.30	11	332.0
109.50	12	332.6
109.70	13	333.2
109.90	14	333.8
110.10	5	334.4
110.30	6	335.0
110.50	7	329.6
110.70	8	330.2
110.90	9	330.8
111.10	10, 17	331.7
111.30	11, 17	332.3
111.50	12, 17	332.9
111.70	13, 17	333.5
111.90	14, 17	331.1

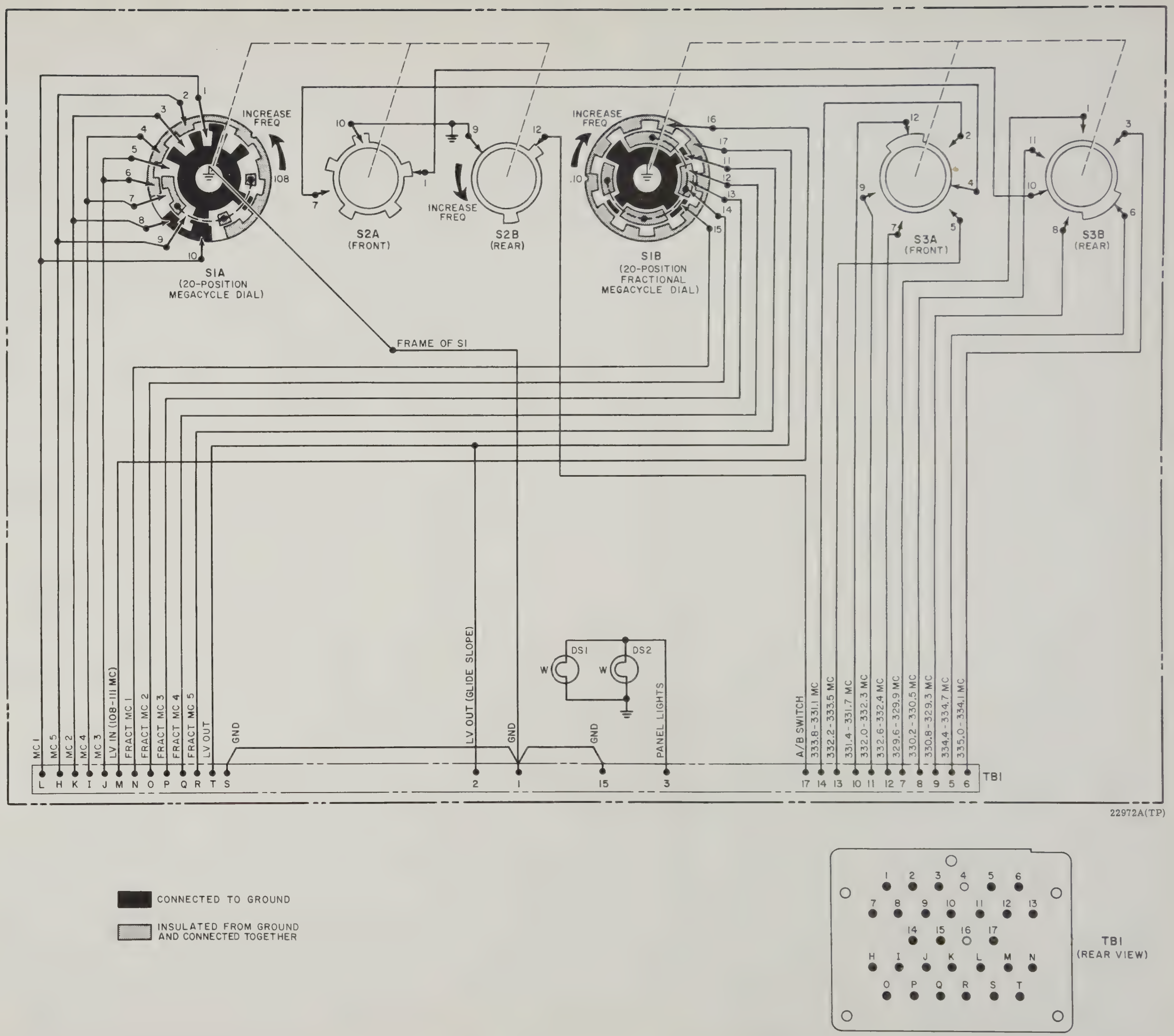


Figure 6–20. CC-12A Custom Control Unit, Schematic Diagram

NOTES:

1. FOR SCHE

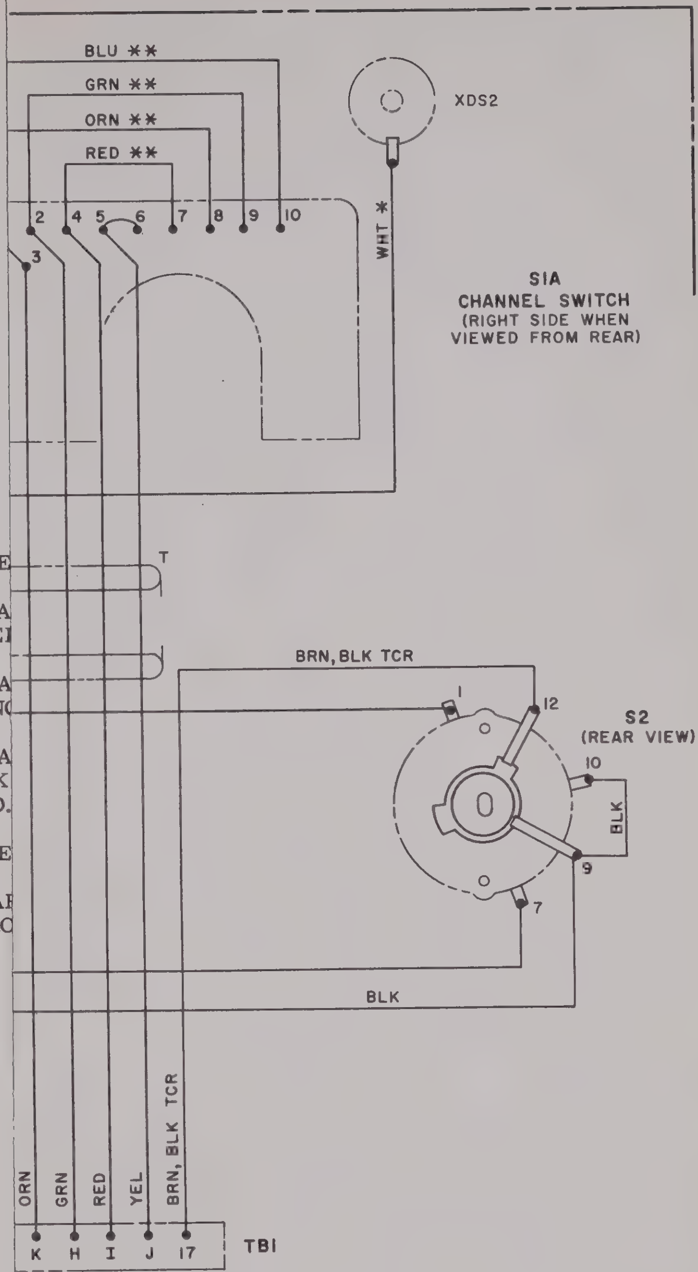
2. WIRES MA
STRANDEI

3. WIRES MA
(*) ARE NC

4. WIRES MA
ASTERISK
SULATED.

5. UNMARKE

6. TRANSPAI
OVER GRC

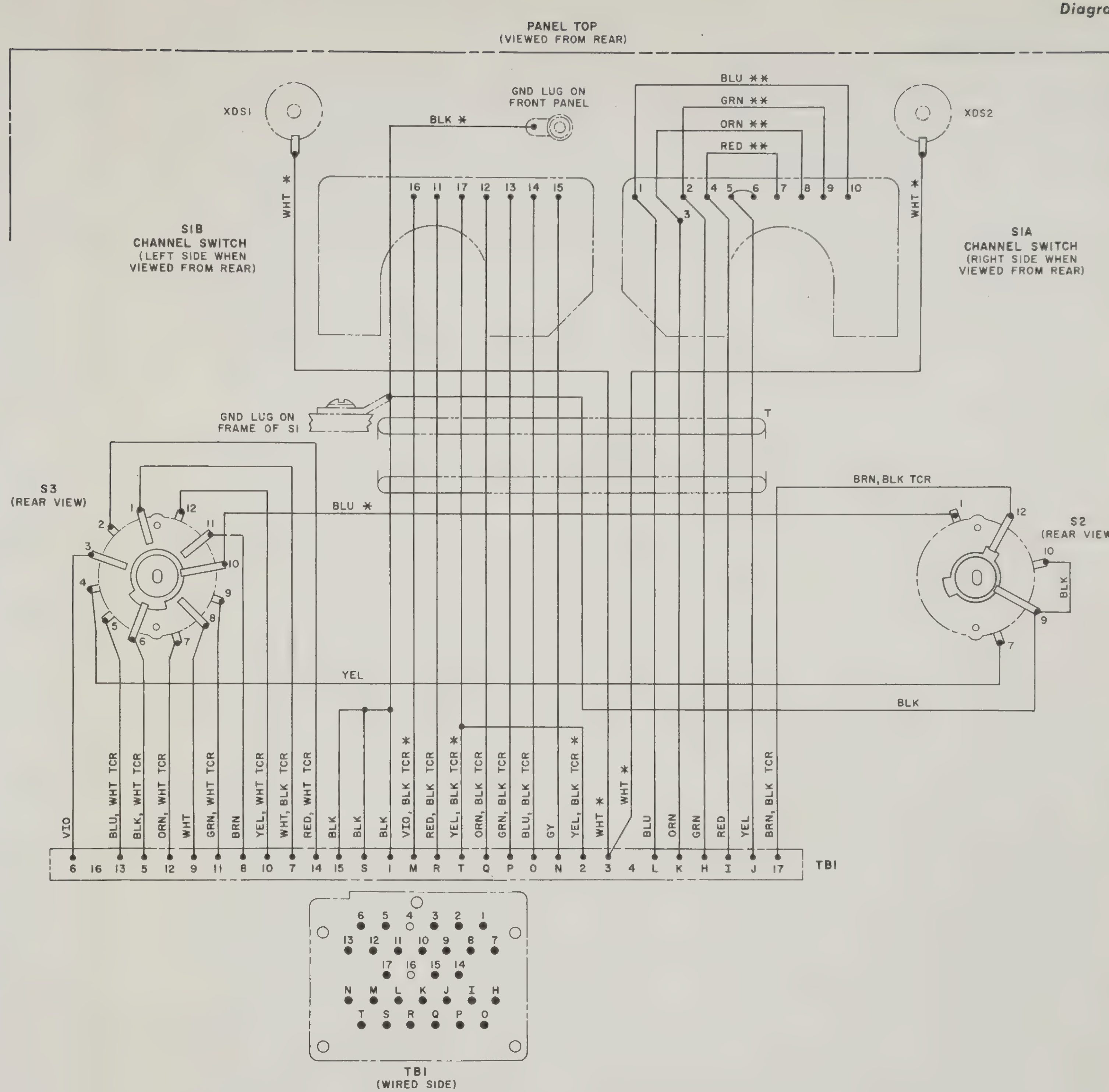


22971A

Figure 6–21. CC-12A Custom Control Unit, Wiring Diagram

NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-20.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 SOLID COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A COLOR NOTE AND A DOUBLE ASTERISK (**) ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
5. UNMARKED WIRE IS NO. 24 BARE, SOLID, TINNED COPPER.
6. TRANSPARENT VINYLITE TUBING (0.313 I.D.) IS INSTALLED OVER GROUPS OF WIRES MARKED "T."



22971A

Figure 6–21. CC-12A Custom Control Unit, Wiring Diagram

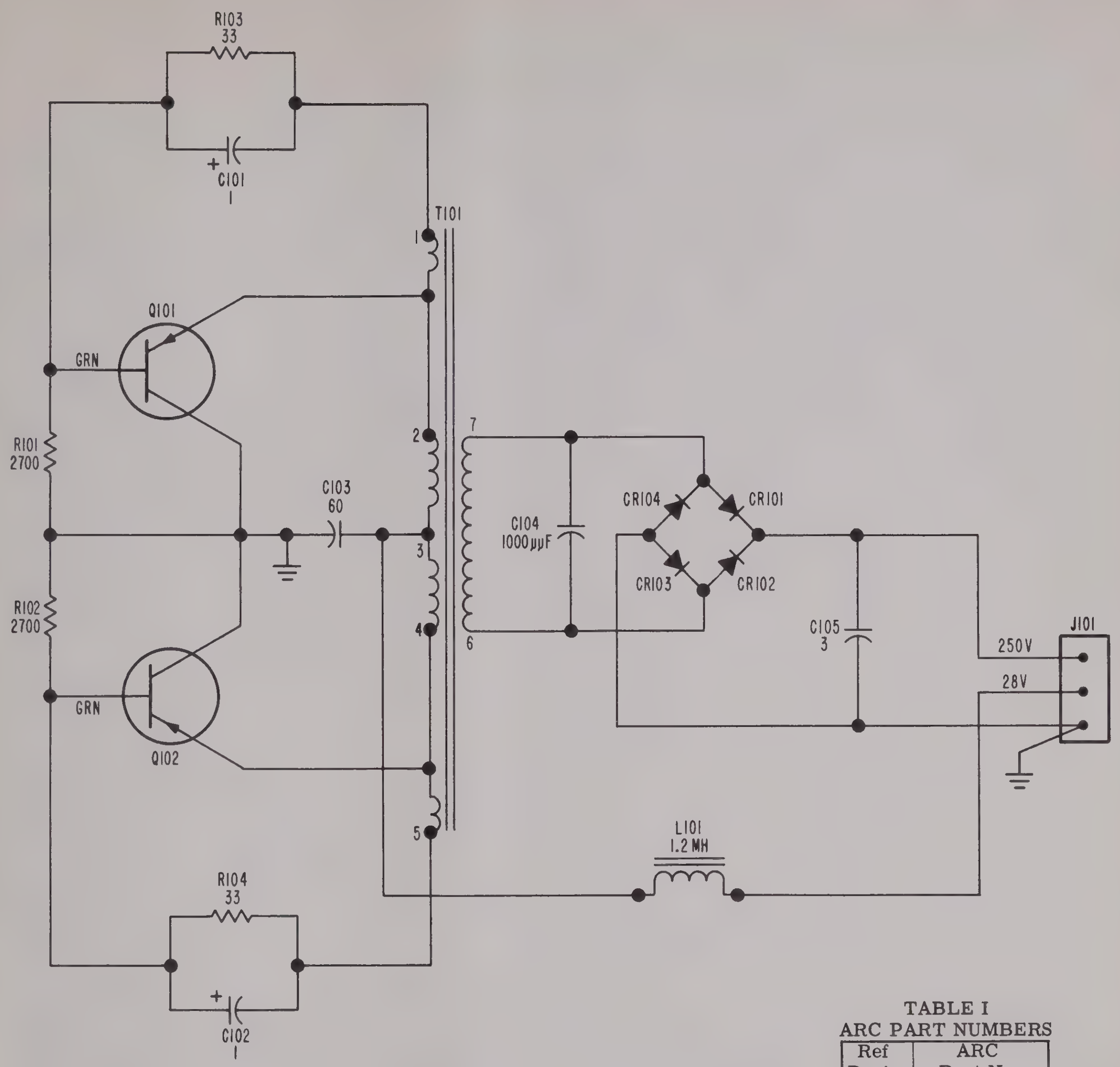


TABLE I
ARC PART NUMBERS

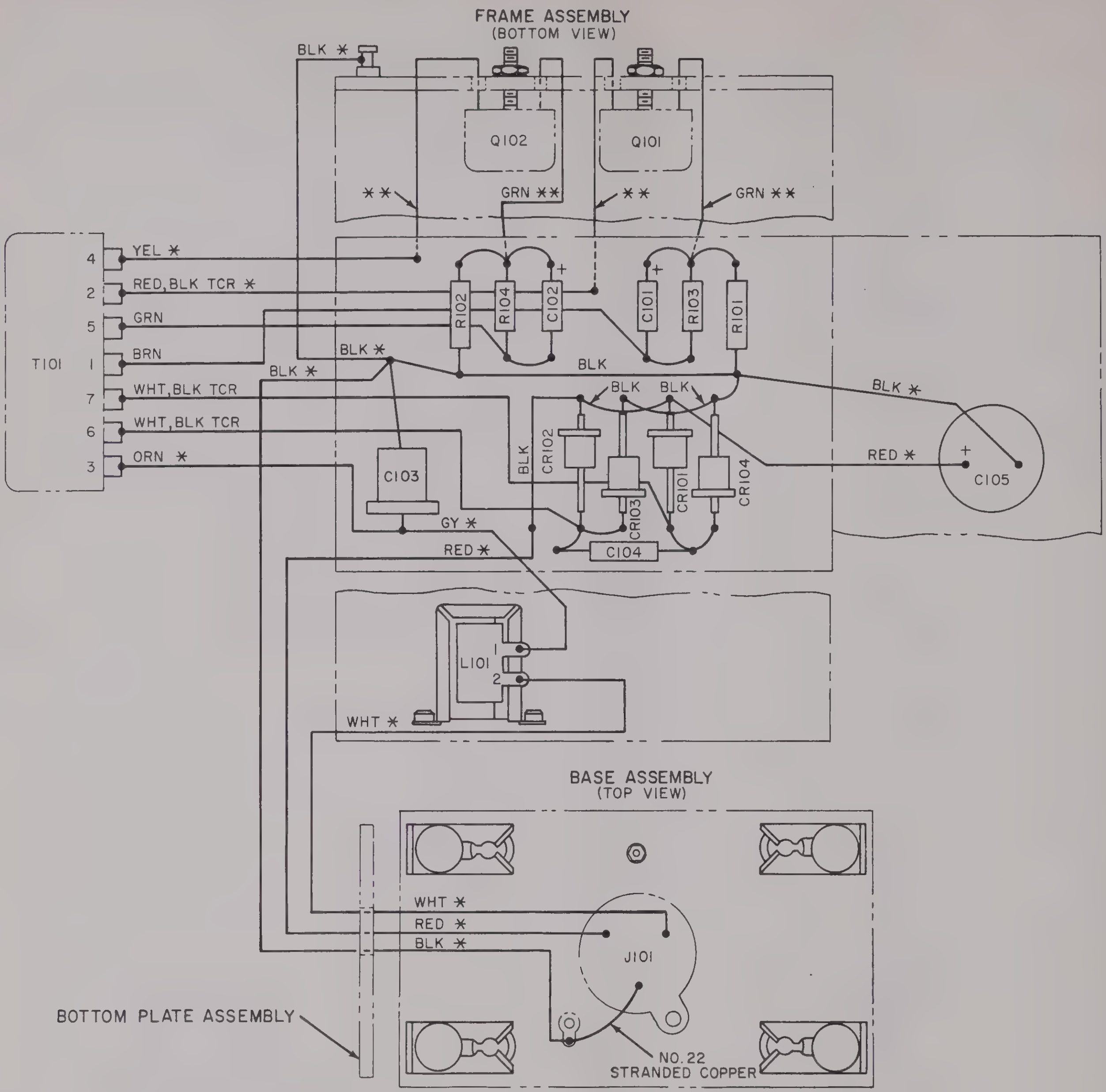
Ref Desig	ARC Part No.
C101	21485-9101
C102	21485-9101
C103	23943
C104	4157
C105	7582
CR101	20474
CR102	20474
CR103	20474
CR104	20474
J101	5211
L101	21429
Q101	20454
Q102	20454
R101	202-0272
R102	202-0272
R103	201-0330
R104	201-0330
T101	20424

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-23.
   CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE NOTED.
3. RESISTOR VALUES ARE IN OHMS.
4. CONNECTIONS ARE SHOWN TO THE TERMINAL SIDE OF RECEPTACLE J101.

TP1581

Figure 6–22. DV-10A Dynaverter, Schematic Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-22.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A DOUBLE ASTERISK (**) ARE FURNISHED WITH THE TRANSISTORS.
5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.

19841I(TP)

Figure 6–23. DV-10A Dynaverter, Wiring Diagram

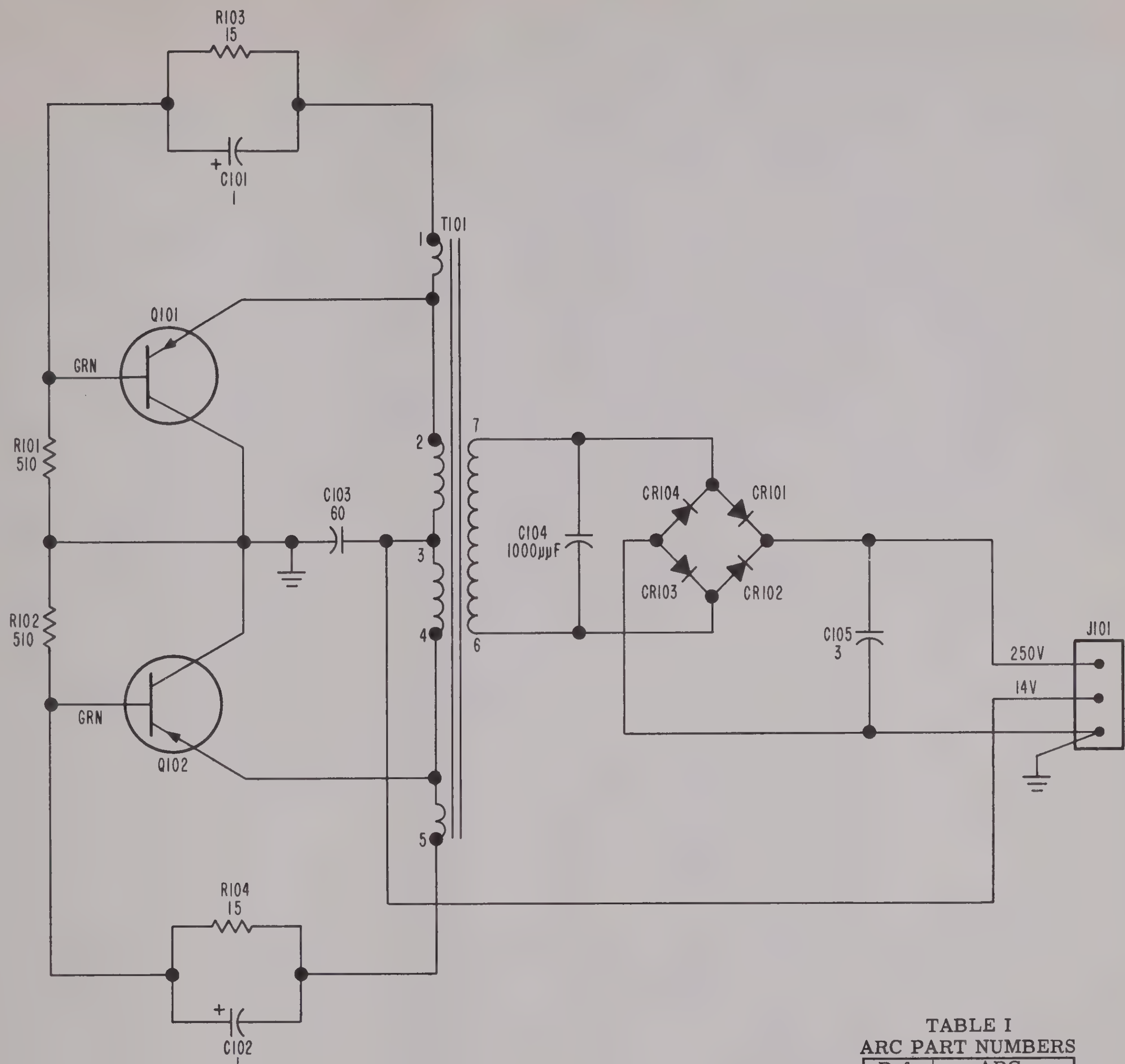


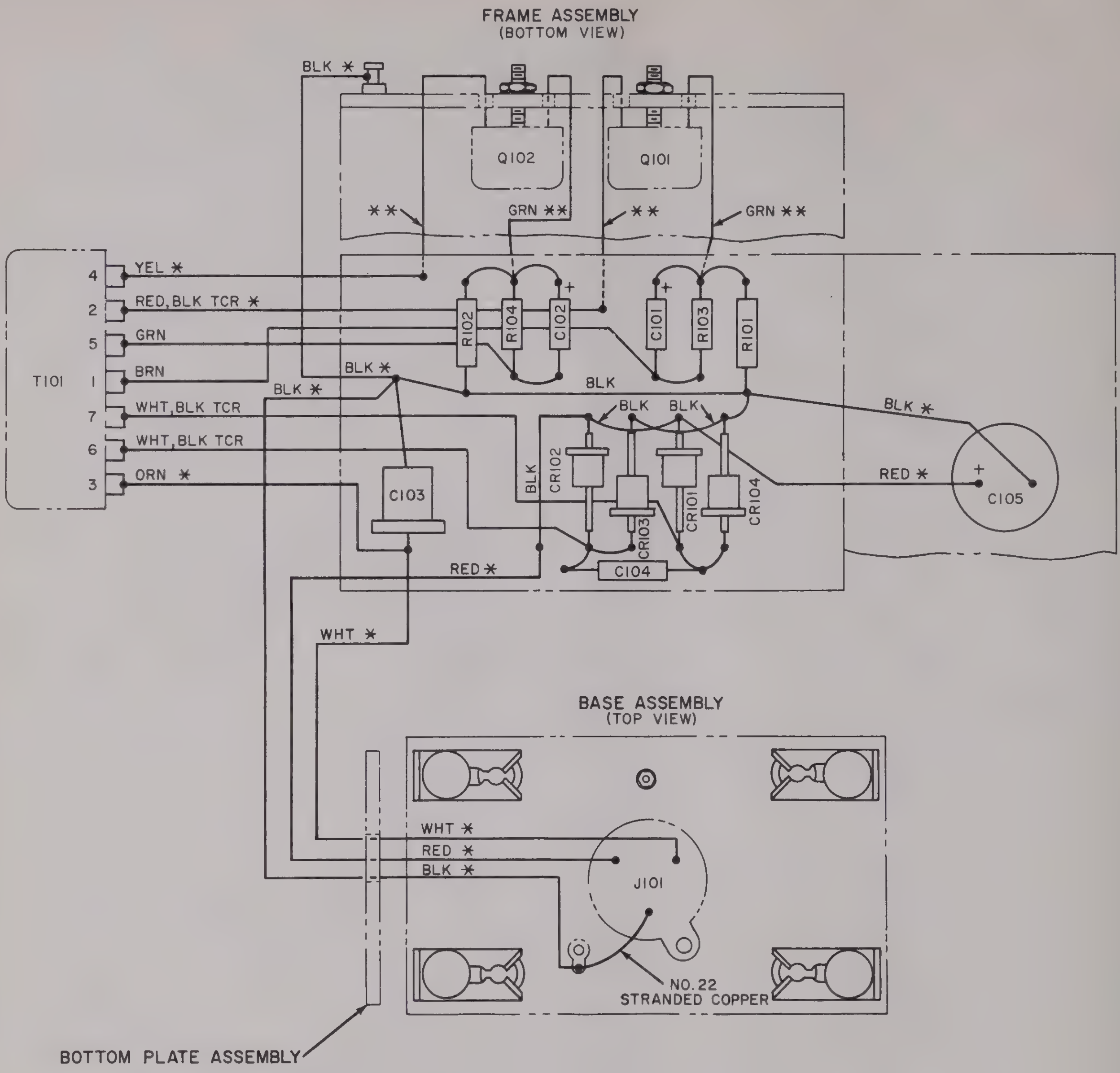
TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
C101	21485-9101
C102	21485-9101
C103	23943
C104	4157
C105	7582
CR101	20474
CR102	20474
CR103	20474
CR104	20474
J101	5211
L101	21429
Q101	21153
Q102	21153
R101	202-0511
R102	202-0511
R103	201-0150
R104	201-0150
T101	21155

NOTES:
1. FOR WIRING DIAGRAM, SEE FIGURE 6-25.
2. CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE NOTED.
3. RESISTOR VALUES ARE IN OHMS.
4. CONNECTIONS ARE SHOWN TO THE TERMINAL SIDE OF RECEPTACLE J101.

TP1583

Figure 6–24. DV-11A Dynaverter, Schematic Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-24.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A DOUBLE ASTERISK (**) ARE FURNISHED WITH THE TRANSISTORS.
5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.

21101F(TP)

Figure 6–25. DV-11A Dynaverter, Wiring Diagram

NOTES:

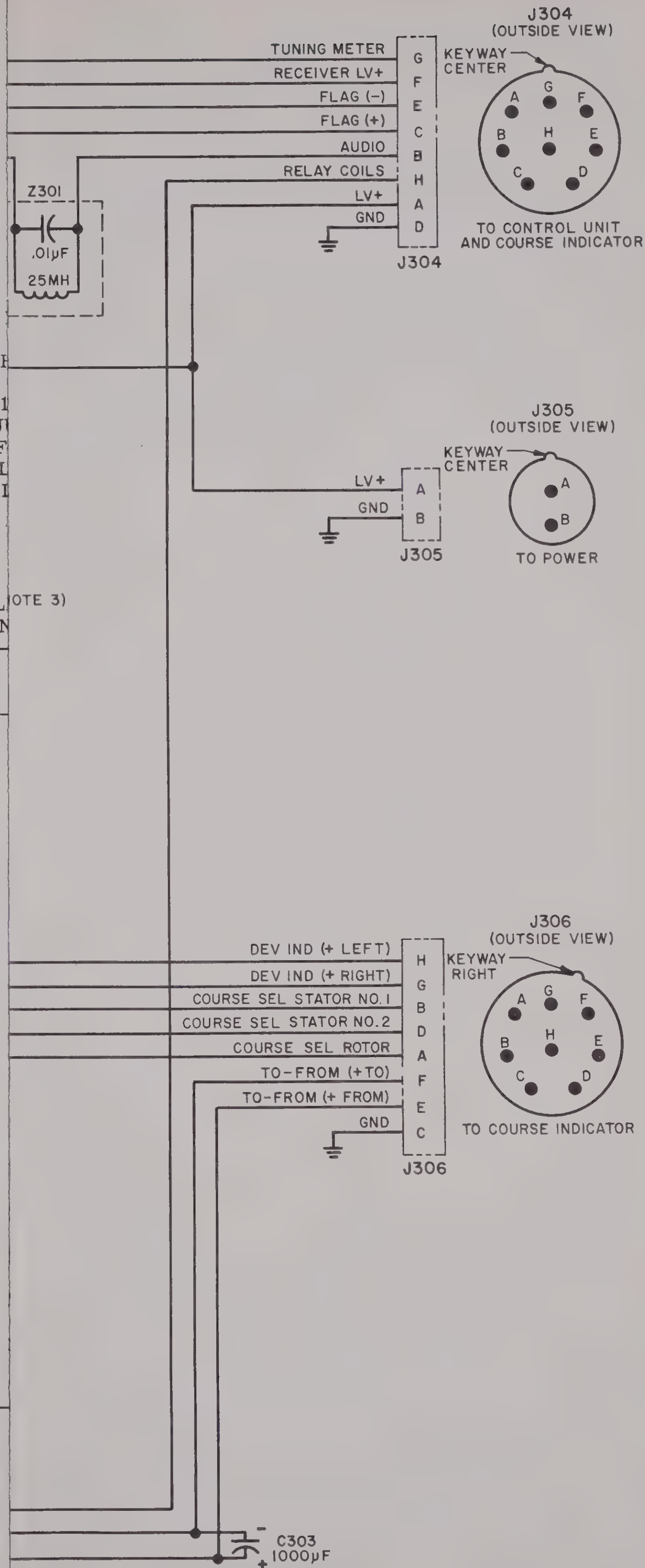
1. FOR WIRING DIAGRAM, SEE

2. RESISTOR VALUES ARE IN OH

3. WITH SHUNT RESISTORS R301
SHOWN, THE SYSTEM IS ADJU
POINTER AND ONE FLAG. F
POINTER (OR EQUIVALENT L
R302; FOR EACH ADDITIONAL
R303 OR R304.

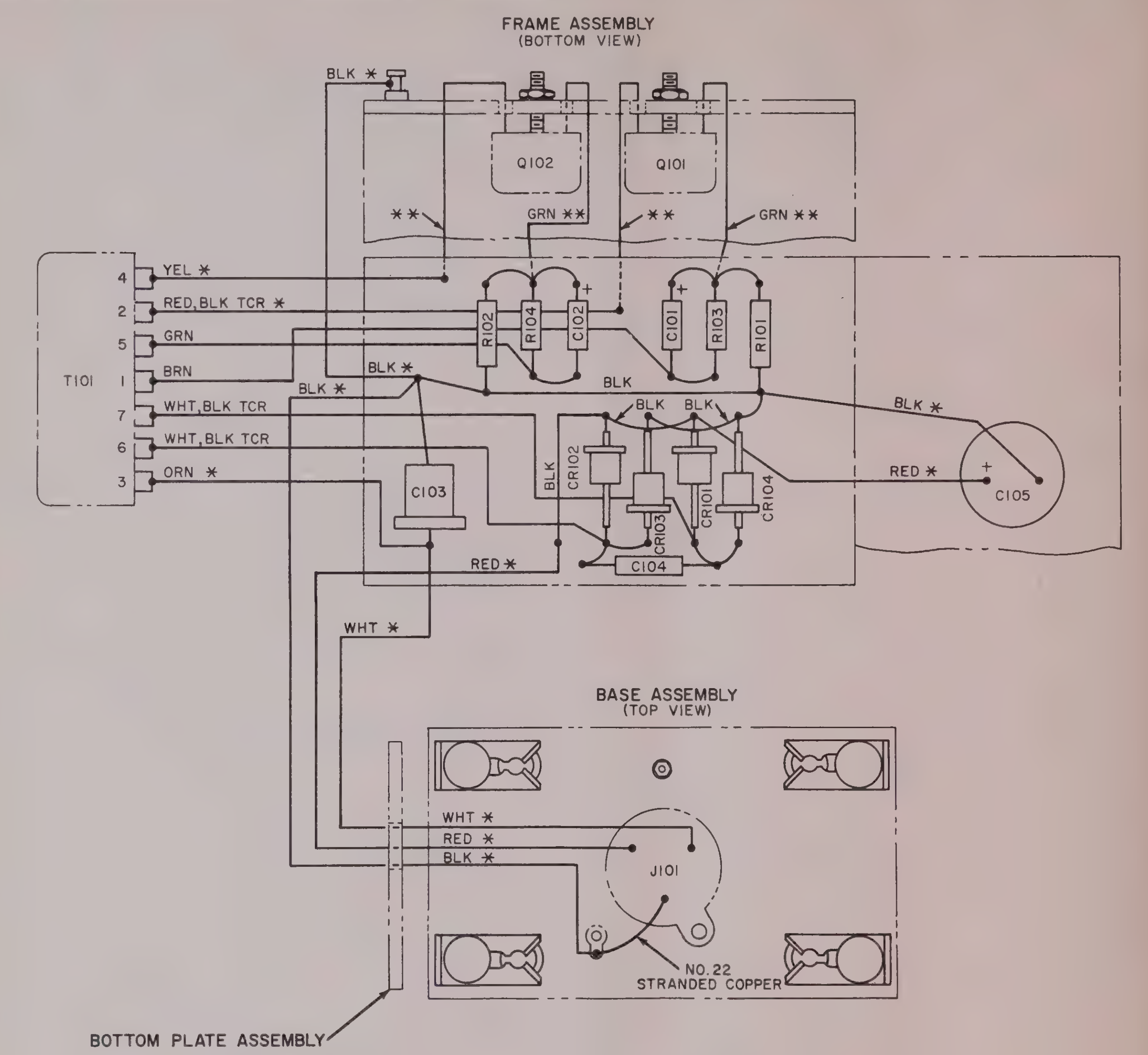
TABL OTE 3)
ARC PART N

Ref Desig	
C301	
C302	
C303	
J301	
J302	
J303	
J304	
J305	
J306	
K301(14V)	
K301(28V)	
R301	
R302	
R303	
R304	
Z301	



15882B(TP)

Figure 6–26. E-14 Rack, Schematic Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-24.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 24 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH A COLOR NOTE AND AN ASTERISK (*) ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
4. WIRES MARKED WITH A DOUBLE ASTERISK (**) ARE FURNISHED WITH THE TRANSISTORS.
5. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.

21101F(TP)

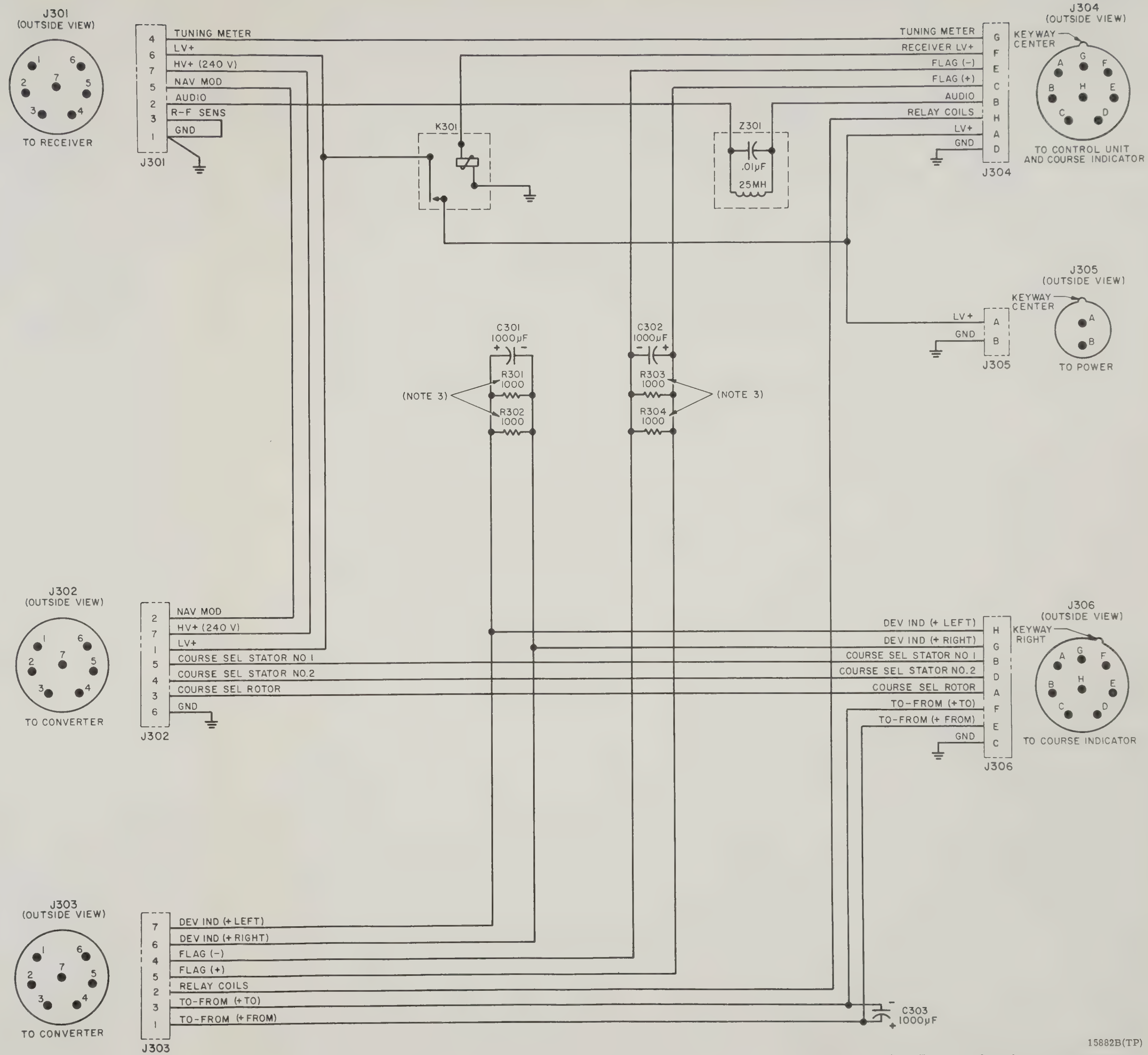
Figure 6–25. DV-11A Dynaverter, Wiring Diagram

NOTES:

1. FOR WIRING DIAGRAM, SEE FIGURE 6-27.
2. RESISTOR VALUES ARE IN OHMS.
3. WITH SHUNT RESISTORS R301, R302, R303, AND R304 AS SHOWN, THE SYSTEM IS ADJUSTED TO FEED ONE VERTICAL POINTER AND ONE FLAG. FOR EACH ADDITIONAL VERTICAL POINTER (OR EQUIVALENT LOAD), REMOVE EITHER R301 OR R302; FOR EACH ADDITIONAL FLAG LOAD, REMOVE EITHER R303 OR R304.

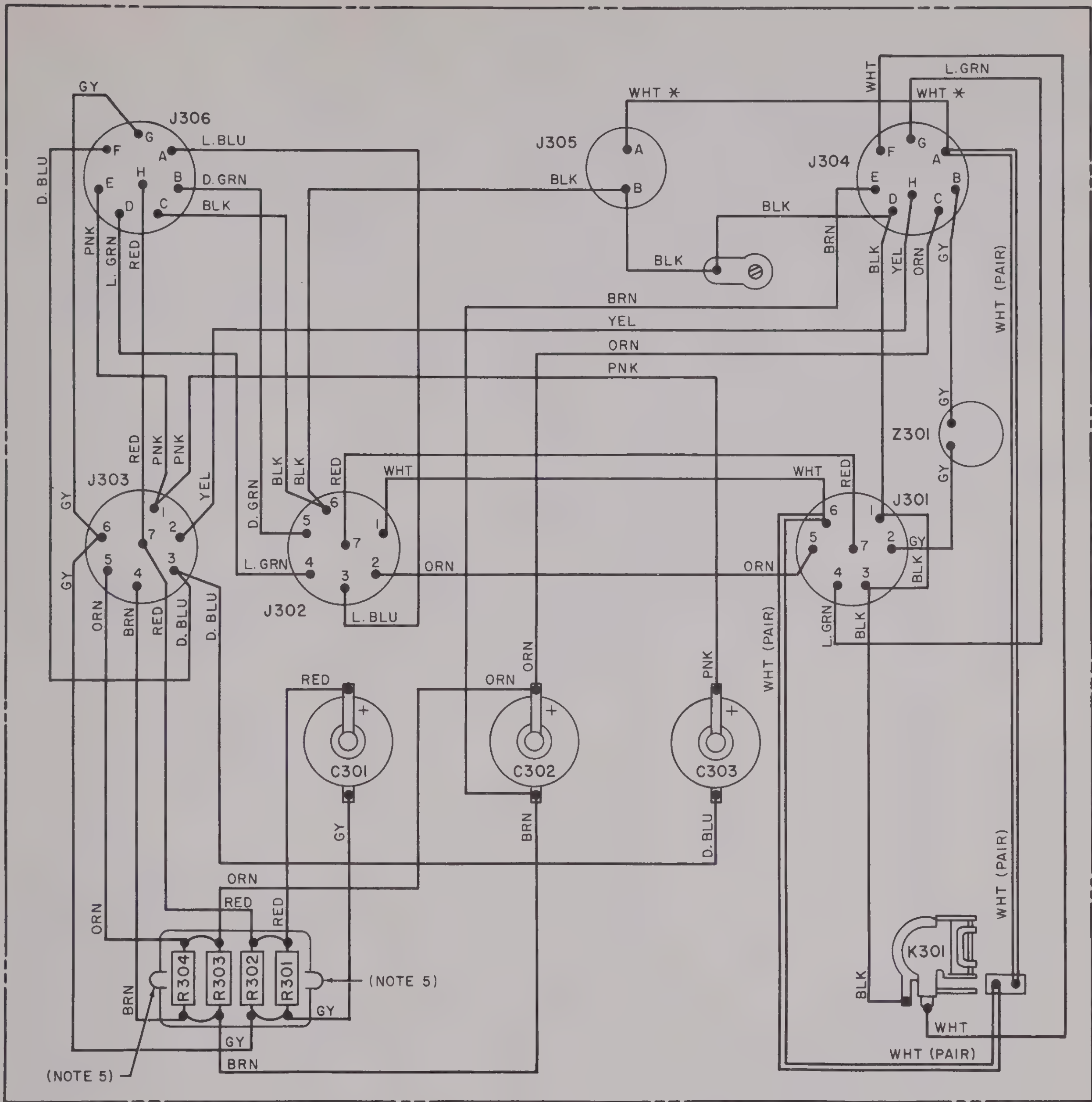
TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
C301	16143
C302	16143
C303	16143
J301	12095
J302	12095
J303	12095
J304	12097
J305	12427
J306	12348
K301(14V)	14484
K301(28V)	14485
R301	201-0102
R302	201-0102
R303	201-0102
R304	201-0102
Z301	16798



15882B(TP)

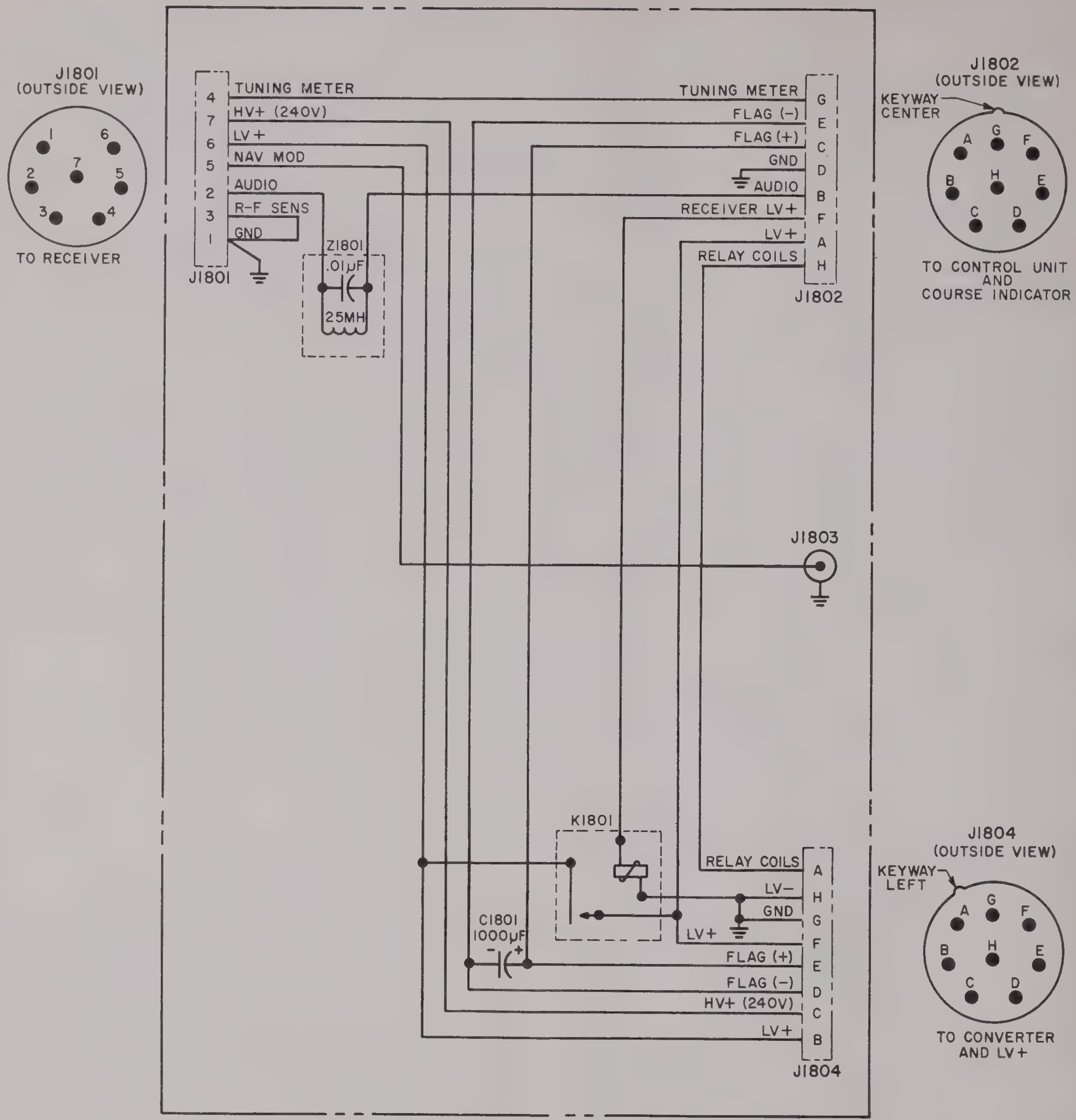
Figure 6–26. E-14 Rack, Schematic Diagram



NOTES:
1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-26.
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 22 SOLID COPPER, VINYLITE INSULATED.
3. WIRE MARKED WITH A COLOR NOTE AND AN ASTERISK (*) IS NO. 18 STRANDED COPPER, VINYLITE INSULATED.
4. UNMARKED WIRES ARE NO. 22 BARE, SOLID, TINNED COPPER.
5. WITH SHUNT RESISTORS R301, R302, R303, AND R304 AS SHOWN, THE SYSTEM IS ADJUSTED TO FEED ONE VERTICAL POINTER AND ONE FLAG. FOR EACH ADDITIONAL VERTICAL POINTER (OR EQUIVALENT LOAD), REMOVE EITHER R301 OR R302; FOR EACH ADDITIONAL FLAG LOAD, REMOVE EITHER R303 OR R304.

Figure 6–27. E-14 Rack, Wiring Diagram

15881E(TP)



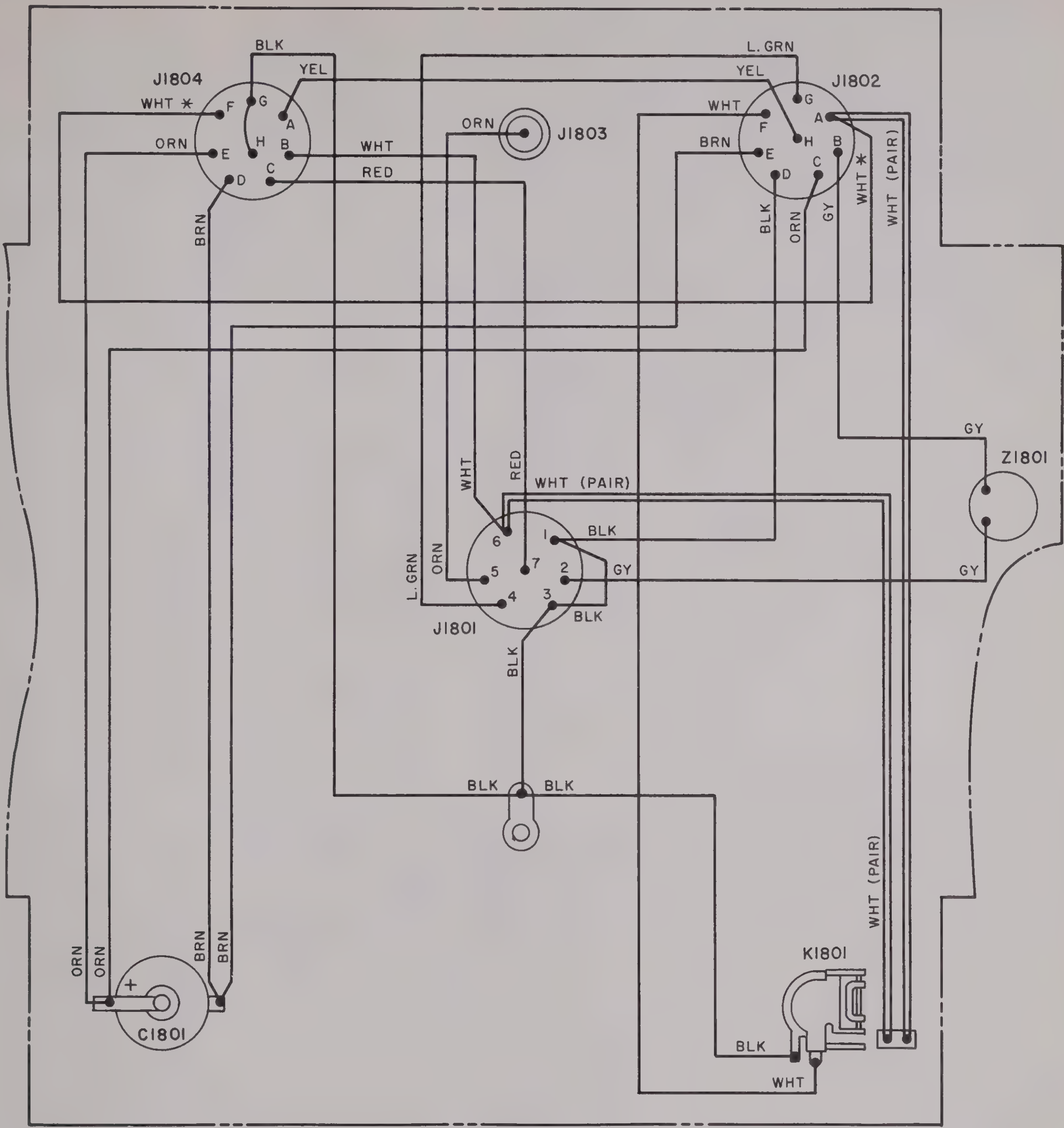
NOTES:
1. FOR WIRING DIAGRAM, SEE FIGURE 6-29.
2. RELAY IS SHOWN IN DEENERGIZED POSITION.

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
C1801	16143
J1801	12095
J1802	12097
J1803	15185
J1804	12355
K1801	14484
Z1801	16798

Figure 6–28. E-15 Rack, Schematic Diagram

16762B(TP)



NOTES:

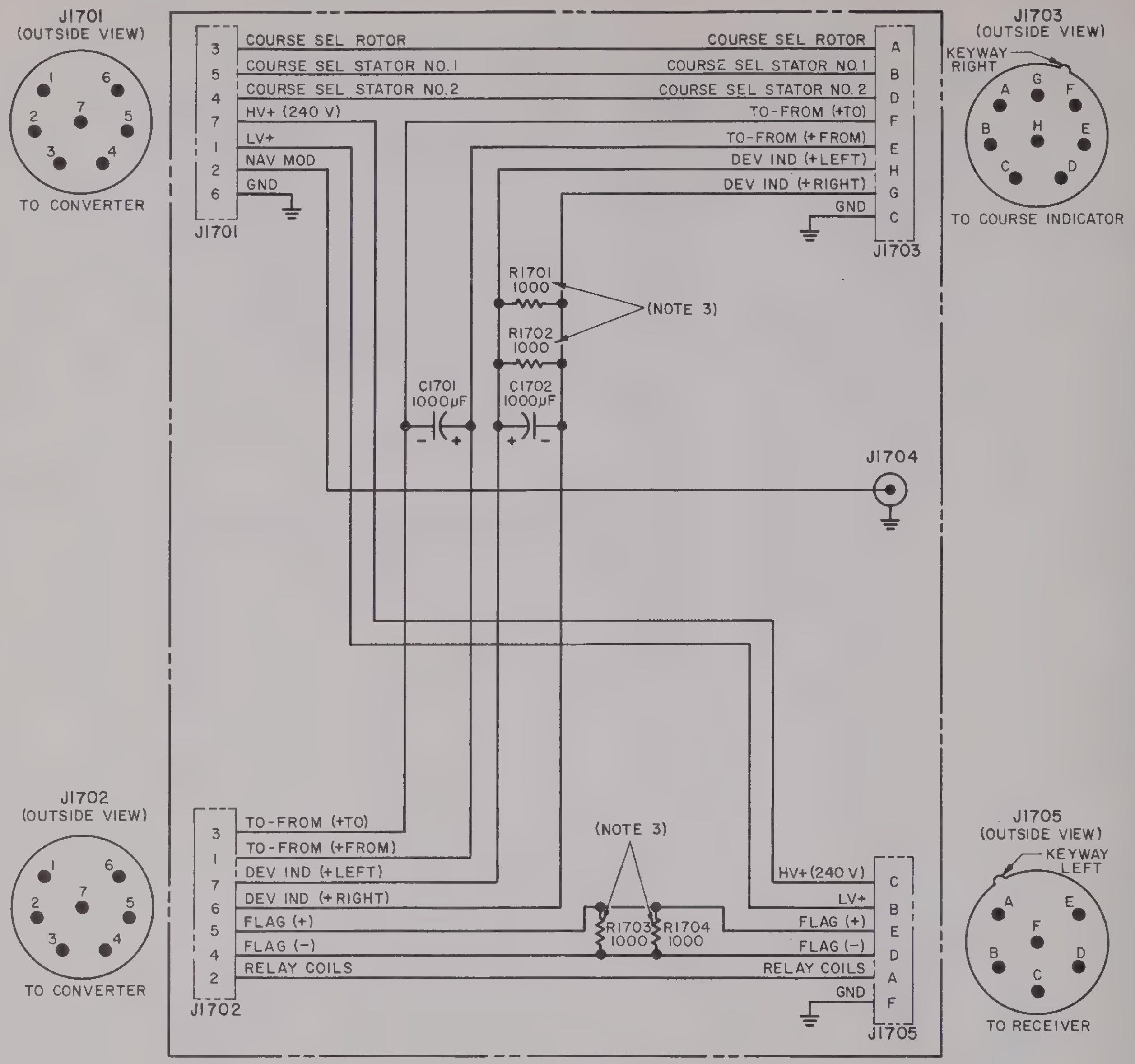
1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-28.

2. WIRES MARKED WITH A COLOR NOTE ARE NO. 22 SOLID COPPER, VINYLITE INSULATED.

3. WIRE MARKED WITH A COLOR NOTE AND AN ASTERISK (*) IS NO. 18 STRANDED COPPER, VINYLITE INSULATED.

16761B

Figure 6–29. E-15 Rack, Wiring Diagram



NOTES:

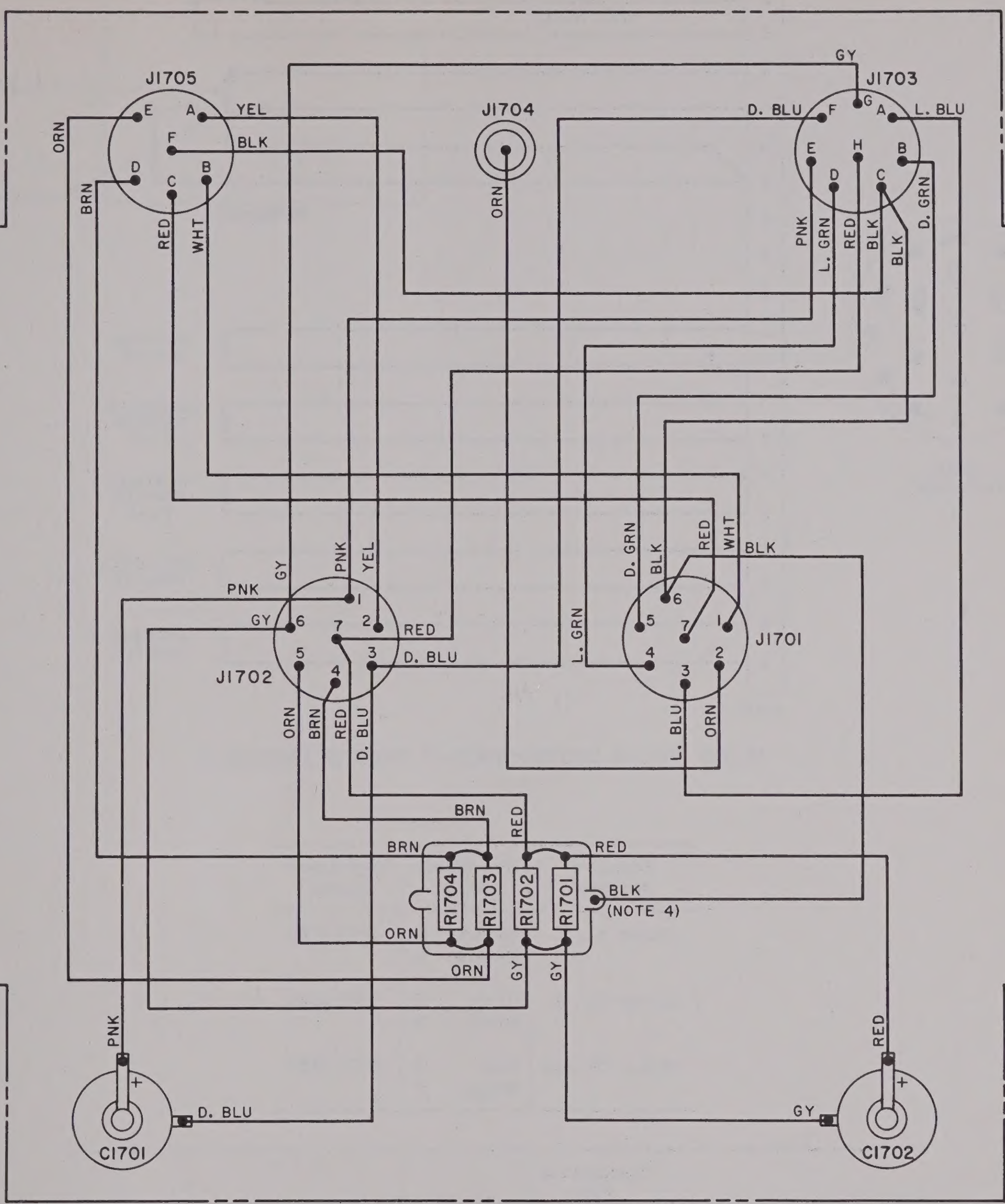
1. FOR WIRING DIAGRAM, SEE FIGURE 6-31.
2. RESISTOR VALUES ARE IN OHMS.
3. WITH SHUNT RESISTORS R1701 — R1704 CONNECTED AS SHOWN, THE SYSTEM IS ADJUSTED TO FEED ONE VERTICAL POINTER AND ONE FLAG. FOR EACH ADDITIONAL VERTICAL POINTER (OR EQUIVALENT LOAD), REMOVE EITHER R1701 OR R1702; FOR EACH ADDITIONAL FLAG LOAD, REMOVE EITHER R1703 OR R1704.

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
C1701	16143
C1702	16143
J1701	12095
J1702	12095
J1703	12348
J1704	15185
J1705	12354
R1701	201-0102
R1702	201-0102
R1703	201-0102
R1704	201-0102

16772B(TP)

Figure 6–30. E-16 Rack, Schematic Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 6-30.

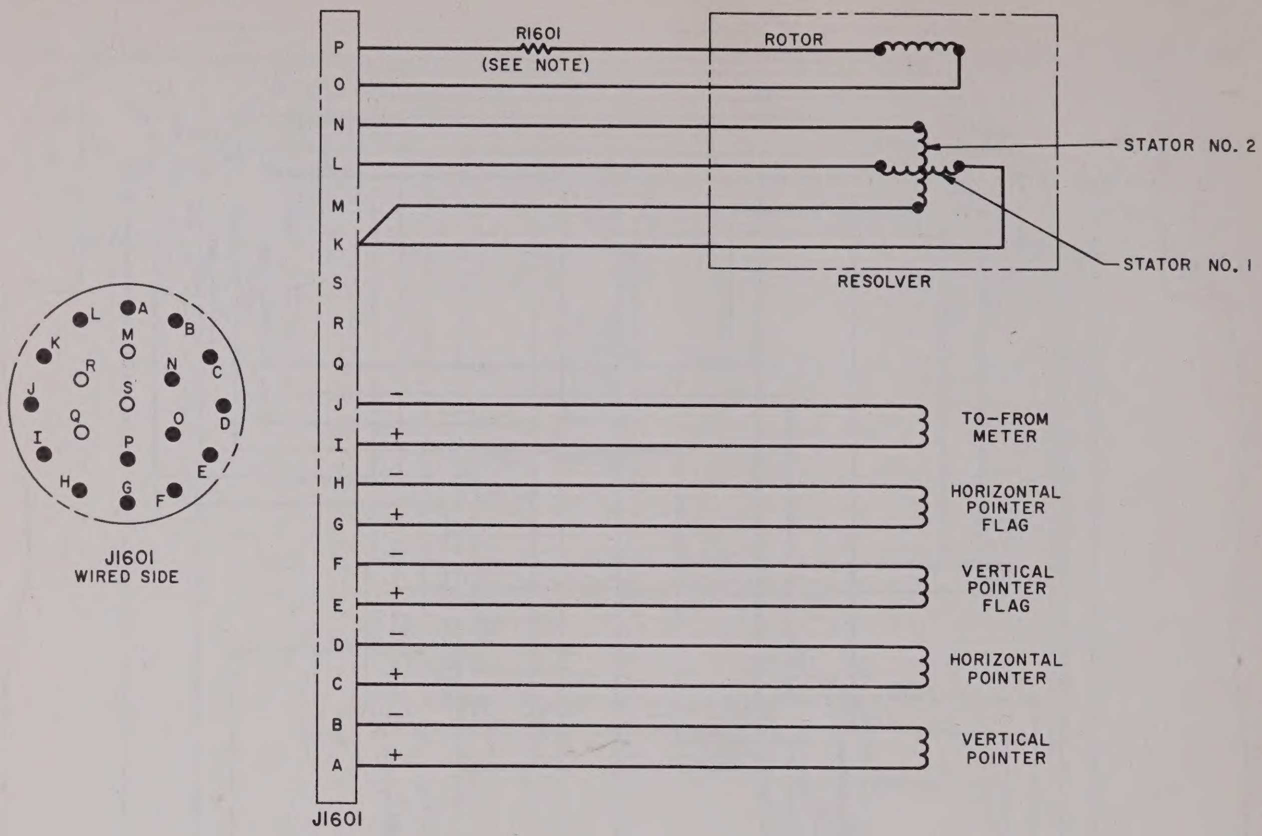
2. WIRES MARKED WITH A COLOR NOTE ARE NO. 22 SOLID COPPER, VINYLITE INSULATED.

3. UNMARKED WIRES ARE NO. 22 BARE, SOLID, TINNED COPPER.

4. WITH SHUNT RESISTORS R1701 — R1704 CONNECTED AS SHOWN, THE SYSTEM IS ADJUSTED TO FEED ONE VERTICAL POINTER AND ONE FLAG. FOR EACH ADDITIONAL VERTICAL POINTER (OR EQUIVALENT LOAD), REMOVE EITHER R1701 OR R1702; FOR EACH ADDITIONAL FLAG LOAD, REMOVE EITHER R1703 OR R1704.

16771B

Figure 6–31. E-16 Rack, Wiring Diagram



NOTE: VALUE DETERMINED AT TIME OF ASSEMBLY.

Resolver Synchro	Receptacle Pins	Resistance (ohms)
Stator No. 1	Green K Yellow L	1040 ±125
Stator No. 2	Grey K Black N	1040 ±125
Rotor Circuit	Red O White P	2775 ±425

Mechanism	Receptacle Pins		Deflection	Sensitivity (microamperes)	Resistance (ohms)
	+	-			
Vertical Pointer	A	B	Right	150-0-150 ±7.5	1000 ±30
Horizontal Pointer	C	D	Down	150-0-150 ±7.5	1000 ±30
Vertical Pointer Flag	E	F	Down	180 Min Suppressed 245 ±11 Concealed	1000 ±30
Horizontal Pointer Flag	G	H	Right	180 Min Suppressed 245 ±11 Concealed	1000 ±30
To-From Meter	I	J	To	90-0-90 ±15	335 ±67

Figure 6–32. IN-10 Course Indicator, Schematic Diagram

16706L(TP)

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